THE EFFECT OF COGNITIVE STYLE ON THE ABILITY TO ATTAIN CONCEPTS AND TO PERCEIVE EMBEDDED FIGURES

By

JAMES FRANCIS DOYLE

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CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

Considerable research effort is currently being expended in studying individual differences in cognitive behavior. One goal of this research has been the identification of the stable, self-consistent patterns of organization which give a person's cognitive behavior its individuality. The term "cognitive style" has entered psychology's glossary to signify the unit of investigation in these studies. The term is meant to conceptualize a behavioral variable that is more personal than situational, one that represents an individual's long-standing predisposition to perceive and respond to events in a manner typically his own.

As a measure of individual differences in cognition, cognitive style is a variable of substantive as well as methodological importance in the study of cognitive behavior. Individual differences in such personal variables as sex, age, social status, and general intelligence have long played a useful methodological role in aiding investigators to control differences which might mask or exaggerate significant data. At the same time, it was always recognized that these variables were epiphenomenal to cognitive behavior. They did not themselves directly affect cognitive processes. This was true even of general intelligence.

The standard measures of intelligence are nothing more than atheoretical dimensions which depict normative levels of intellectual performance but say nothing of the personal nature and manner of that performance.

Cognitive style, on the other hand, is properly a cognitive measure of individual differences in cognition. Style of any sort is the characteristic way an individual behaves: his cognitive style is the manner in which he typically perceives, thinks about, and responds to his environment. Cognitive style, therefore, is phenomenal to cognition and, as such, may be used not only to increase precision and control in the investigation of cognitive processes but to further the substantive explanation of those processes.

Present research interest in cognitive style, then, represents the effort of psychologists to elaborate the study of cognition by paying greater attention to its personal, individual nature. The premise of this research has been that individuals cognize reality in distinctive, characteristic ways; that they develop, as Klein says, "definitive modes of meeting the world" (1951, p. 331). When these distinctive cognitive styles are defined, theoretically and operationally, otherwise erratic individual differences become dimensioned variables of cognitive behavior. Thus, under the rubric of cognitive style individual differences in cognitive functioning serve to elucidate rather than obscure the nature of human thought.

To date, a number of cognitive style dimensions have been identified. In general, this has been accomplished by demonstrating that individuals who perform alike on a specific cognitive task resemble one another in a broad and varied array of personal and cognitive characteristics. Where these characteristics have been seen as exhibiting an intrinsically coherent behavior pattern, that pattern has been conceptualized as a cognitive style dimension. The original specific cognitive task then becomes the operational definition of a difference in individuals which is broadly psychological rather than narrowly cognitive.

One cognitive style dimension which has been the object of extensive investigation is the familiar analytic-versus-global mode of cognitive functioning. This dimension distinguishes persons according to the degree to which they differentiate their experience. It measures the tendency to respond to stimuli analytically by breaking a stimulus down into its constituent parts in preference to dealing with it globally. The psychological significance of this cognitive style dimension was first recognized in the early psycho-physical experiments on sensory thresholds. "Analytic" subjects in these experiments were found to have had lower thresholds than "synthetic" subjects. More recently, investigators have been concerned with the development, stability, and pervasiveness of analytic and global styles in individuals (Witkin et al., 1954, 1962; Kagan et al., 1960, 1963, 1964).

One team of investigators (Kagan, Moss, and Sigel, 1963) has been successful in developing a convenient paper-pencil test, the Conceptual Style Test (CST), for identifying subjects who are more analytic than global in their cognitive style. Designed for use with children, this test identifies analytic subjects by the preference they show for using one or another differentiated part of pictured objects as the basis for classifying the objects as similar or alike. Global, non-analytic subjects, on the other hand, are identified by their tendency to find similarities or relationships between the objects taken as unitary wholes. These investigators have called their more analytic subjects splitters and their more global subjects lumpers. After a series of investigations into the cognitive behavior of splitters and lumpers, Kagan and his colleagues have concluded that the preference for analytic or global categorization measured by the Conceptual Style Test (CST) is representative of a mode or style of cognitive behavior that is stable and self-consistent across a generality of cognitive tasks (Kagan, Moss, and Sigel, 1963).

As a consequence of this finding, these investigators have proposed that future investigations of cognitive processes should control for differences in this stylistic dimension, much as past investigations have controlled for differences in sex, age, IQ, and social class (Kagan, Moss, and Sigel, 1963). In response to this recommendation, the present study was designed to investigate the effect of a person's cognitive style, as defined by the CST, on his performance on a concept formation task and a perceptual discrimination task. The expectation was that this would demonstrate both the methodological and the substantive advantage of examining cognitive behavior in the light of personality-centered dimensions of cognitive functioning.

A primary concern was to find whether a person's cognitive style would either facilitate or inhibit his cognitive performance on these tasks.

Following Floyd Allport's suggestion (1955, p. 218) that long-standing personal modes of cognitive functioning be studied and analysed in the theoretical terminology of "mental sets," this study conceived cognitive style as the characteristic einstellung, or set, which a person would bring into a cognitive task situation. Thus it was theorized that a person's task performance would be facilitated or inhibited in the degree that his cognitive style was appropriate or inappropriate to the immediate cognitive task.

A person's task set, however, was not assumed to be determined entirely by the predispositions engendered by his particular cognitive style The definition given to the task, in terms of task instruction and orientation, was also considered an important determinant of the set with which a person would approach the solution of a task (Bruner, 1956, p. 56). Thus, other things being equal, the more clearly instruction and orientation define a task for a person, the more likely he will be to adopt an appropriate task set. Furthermore, it seemed reasonable to assume that task set, whether due to cognitive style predispositions or to preliminary task orientation, would not always be uniformly influential in determining subject performance. Specific problem formulations of a task usually differ in difficulty or complexity, and an appropriate task set may vary in its importance for aiding in the solution of a task, depending on the difficulty level of the problem.

To investigate the facilitating or inhibiting effect of cognitive style on performing a task, it was deemed proper to adopt an experimental design in which both the level of task orientation and the level of task difficulty were controlled. To that end, the task performance of subjects in this study was examined under three levels of task orientation and four levels of problem difficulty.

A priori examination of the concept formation and embedded figures tasks used in this study indicated that they were both analytical in nature, requiring a subject to discriminate the relevant part of a larger stimulus complex. As such, they represented tasks whose solution would be facilitated in the case of analytic subjects and inhibited in the case of global subjects.

Bruner (1956) has used concept formation tasks to identify various strategies subjects employ in attaining concepts. One of these strategies, _conservative focusing_, is a particularly analytic style of problem solving. Witkin has used the perception of embedded figures to determine the degree to which subjects are _field independent_, a dimension which he has independently employed to define an analytic cognitive style. Both tasks therefore have special significance in connection with the analytic-global dimension of cognitive style. Using these specific cognitive tasks to examine performance differences between splitters and lumpers made it possible to study the analytic-global dimension of cognitive style in terms of results that would generalize across three independent operational measures of what appears to be the same theoretical dimension. To the extent that there is considerable overlap in the operational procedures of Kagan, Bruner, and Witkin, the theoretical nature of the analytic-global dimension of cognitive style becomes a more precisely defined construct

Statement of the Problem

The purpose of this study was to examine the effect a person's cognitive style had on facilitating or inhibiting his success in attaining a concept and perceiving an embedded figure under different levels of task orientation and problem difficulty. The specific cognitive style dimension investigated was the analytic-global construct which Kagan and his colleagues have operationally defined in terms of a person's preference for analytic categorizations.

If the results of the study were to bear out the thesis that cognitive style is a significant determinant of performance on cognitive tasks, then further support would have been found for the recommendation that studies of cognitive functioning should control for differences in cognitive style. In an effort to give the study's results a wide theoretical significance, the two cognitive tasks used in this investigation were ones which have independently served as operational measures of the analytic-global construct: namely, Bruner's measure of concept attainment strategy, and Witkin's measure of field independence.

The importance of the problem investigated stemmed from recent attempts to use cognitive style dimensions to identify and order crucial personality differences in cognitive functioning. The present study was designed to test the supposition that the analytic global dimension of cognitive style has come of age as a personality-centered cognitive variable that has both methodological and substantive value for the explication of intellectual processes.

CHAPTER II

REVIEW OF RELATED RESEARCH

Cognitive style dimensions have been proposed as important personality variables for the study of cognitive functioning because they represent the stable, pervasive, self-consistent ways in which individuals cognize reality. They are the dimensions defining an individual's characteristic responses to stimuli. As psychological variables, they predict the reaction of the same individual in different situations and the reactions of different individuals in the same situation. Their scientific generality, in other words, is personal not situational.

This chapter is a review of recent research that has been directed toward the identification and calibration of the analytic-global cognitive style. The focus of the review was on findings pertinent to the supposition that a person's preference for making analytic or global categorizations was predictive of the responses he would make in a variety of perceptual and cognitive situations.

Research Related to Defining the Analytic-Global Dimension of Cognitive Style

At a theoretical level, there seems to be general agreement that the analytic-global dimension of cognitive style describes a continuum whose one end marks cognitive functioning that is active, analytical, articulated, specific, and critical; and whose other end marks passive, global, vague, diffuse, uncritical cognitive functioning (Wallach, 1962, p. 200). This theoretical interpretation of what is meant by the analytic-global dimension of cognitive style was arrived at by induction from findings on specific, empirical investigations of the stable individual differences characterizing performance on a number of cognitive tasks. The two major investigative efforts following this method of inquiry were those of the Witkin group (1954, 1962) and the Kagan group (1963, 1964).

Kagan and his colleagues began their investigation of the analytic-global construct with a task that required subjects to group or sort a large array of human figures in any manner desired. This task clearly differentiated between individuals who sorted the figures on the basis of carefully defined descriptions of physical characteristics and those who grouped them on the basis of ill-defined, vague thematic relationships. In explaining the performance differences exhibited by subjects in this task, Kagan and his colleagues proposed that the analytic group was engaging in an active conceptual analysis of the stimulus array, while the global group was passively accepting the stimuli in terms of their most obvious aspects (Kagan, Moss, and Sigel, 1963, p. 76).

Personality assessments of these contrasting groups supported this contention. Subjects who produced analytic conceptual sorts were rated as persistent in the face of problem situations, confident in their approach to challenging intellectual tasks, and motivated to obtain achievement-related goals. Those who preferred global conceptualizations were more inclined to be dependent in interpersonal situations, not overly ambitious, and less inclined to labile sudomotor reactions. Thus, the ground was laid for the conclusion by Kagan and his colleagues that an individual's response to a conceptual sorting task was indicative of a pervasive personality variable which represented one dimension of his individual style of cognitive functioning.

Subsequent to these initial efforts, the Kagan group developed the Conceptual Style Test (CST) to serve as the defining task in differentiating analytic from global subjects. This test is described in Chapter III of this study. The CST was designed to be suitable for use with children because Kagan and his colleagues were particularly interested in studying the "antecedent events that predisposed a child to develop and maintain an analytic attitude (Kagan, Moss, and Sigel, 1963, p. 82). When the behavioral patterns of children identified as either analytic or global by means of the CST were studied, confirming evidence was found that the response differences revealed by this test were pointing to broader, stylistic differences in cognitive functioning. Analytic children were found to possess in common a cluster of personal behaviors that included having a reflective attitude, a tendency to differentiate experience, and the ability to resist the effects of distracting stimuli on ongoing behavior. Global children, on the other hand, were characterized as impulsive, more reactive to external stimuli, and less likely to differentiate complex stimulus situations. Intellectually, analytic children differed from global children in word associations, organization of words for commitment to memory, and interpretation of ink blots and TAT pictures (Kagan, Moss, and Sigel, 1963, p. 101).

The research of Witkin and his colleagues (1954, 1962) on the analytic-global dimension of cognitive style began with tasks that were more perceptual and less verbal than the Kagan group's conceptual classification tasks. Witkin's tasks required a subject to orient himself vertically while placed in a tilting room, to move a rod to a vertical position while it was surrounded by a tilted frame, and to find a simple visual figure embedded in a more complex pattern. Subjects who were more successful on these tasks were described as field independent; less successful subjects were designated field dependent. The difference between them was explained in terms of the degree to which subjects could free themselves from the influence of a surrounding perceptual field.

Like the Kagan group, the Witkin researchers enlarged the psychological significance of their narrow test differences to embrace a broader analytic-global dimension of deep-seated personality differences in cognitive functioning. In general, field-independent persons were found to articulate both their social and non-social environments with greater clarity and precision than field-dependent persons. Behaviorally, this tendency to articulate experience differentially manifested itself in "capacity for self-care, ability to assume responsibility, nature and bases for friendships, and kind and depth of interests" (Witkin et al., 1962, p. 268). Intellectually, field-dependence-independence was found to correlate with the parts of conventional intelligence tests which require an analytical approach, with success on insight problems which required restructuring, with clarity of experience in unstructured test and interview situations, with ability to articulate body concepts, and with the ability to manifest a sense of separate identity (Witkin et al., 1962, passim).

Gardner, in his independent investigations of the field-dependent-independent construct, has expanded its interpretation to include the notion that Witkin's test procedures are actually tapping "individual differences in the capacity to attend and respond selectively to relevant vs. irrelevant cues" (Gardner, 1962, p. 193). This would suggest, as Kagan himself has noted, that there is a good deal of similarity in the theoretical construct being defined by Witkin's measures of field-dependence-independence and Kagan's measures of analytic-global conceptual preference. In this respect, Kagan has stated that the formation of analytic concepts requires "a careful and purposive analysis of the stimulus and a differentiation of relevant from irrelevant cues" (Kagan, Moss, and Sigel, 1963, p. 78).

Gardner based his interpretation of the Witkin construct on the results of studies he conducted on the relationship between field independence and the ability to overcome illusory effects when given brief instructions on resisting illusions by means of selective concentration and attention. His results indicated that the analytical orientation described by the Witkin group might actually imply a superiority in selectivity of attention to relevant vs. compelling irrelevant cues without regard to whether the relevent item was the embedded figure or its surround. In one study, for example, using the concentric circles illusion of Delboeuf and some related figures, Gardner (1961) found that subjects adept in Witkin's Embedded Figures Test showed less illusion both when asked to respond to the embedded circles and when asked to respond to the surrounds.

In reviewing the research findings of the Witkin group, Paterson (1962) has also suggested the notion of contrasting field-independent and field-dependent subjects in terms of a general ability to distinguish relevant from irrelevant perceptual clues. Paterson noted the fact that a field-independent attitude correlated with success on the picture completion, block design, and object assembly subtests of the Wechsler (Goodenough and Karp, 1961). These subtests require a subject to analyze a picture of a familiar object to find a missing part, dissect a design into its components in order to reproduce it, break down a given configuration and integrate its parts into a new whole. Furthermore, field-independence also correlated with a subject's degree of clarity and specificity in describing ink blots (true also of Kagan's splitters) and with a subject's degree of clarity and articulateness in describing his environment and himself in an interview situation (Witkin, 1962, passim).

Both Gardner's experimental results and Paterson's interpretation of the research findings of the Witkin group support the contention that the Witkin operations and the Kagan measures are operationally defining a theoretically similar dimension of cognitive style. Wallach (1962), however, has called this position into question. He has noted the fact that both Kagan and Witkin have been able to embrace contrary empirical findings within their respective theoretical constructs. Kagan, Wallach points out, found that his operational measures correlated with the verbal sub-tests of the Wechsler, while Witkin found that his operational procedures correlated with the performance sub-tests and not with the verbal. Yet both Witkin and Kagan have been able to explain these findings in terms of the analytic-global dimension of cognitive style: Kagan (Kagan and Moss, 1960, cited in Wallach, 1962) by asserting that the Wechsler vocabulary and information sub-tests are dealing with the degree of clarity and criticalness with which a person analyzes his world (scoring in the Wechsler varies with specificity of word definitions); and Witkin by stating that the Wechsler picture completion, block-design, and object assembly sub-tests are related to a person's ability to analyze a whole in terms of its parts (Witkin, 1962, p. 61), and it is this perceptual aspect of intelligence that the analytic-global cognitive style influences.

Obviously, "being analytic" seems to mean something different in these two instances: verbal but not perceptual capabilities in the one case, and perceptual but not verbal in the other. Wallach's conclusion was that both groups are using measuring instruments that were too narrow and task specific. The theoretical meaning of the analytic-global distinction appears to become blurred when its operational definition is narrowly verbal or narrowly perceptual. What is needed, Wallach said, is a broader multidimensional measuring instrument which can register the multiple factors which may be at work in generating an analytic or global cognitive style.

Wallach's criticism was based on Kagan's early reports of his work. Since then, studies with younger children have found no correlation between an analytic score on the CST and a high WISC vocabulary subtest score that was greater than .15. Moreover, correlations of .58 and .55 between the CST and the WISC picture arrangement subtest and of .22 and .37 between the CST and the WISC picture completion subtest have led the Kagan group to realize that the perceptual aspect of their criterion measure may be more critical than its verbal features (Kagan et al., 1964). While this would support Gardner's belief that Witkin and Kagan are getting at the same theoretical dimension of cognitive style, it is still probable that the theoretical construct of analytic-global style is multiply determined and therefore inadequately assessed by any single criterion test procedure. In discussion with Wallach, Kagan himself has accepted this much of the Wallach critique (Kagan, Moss, and Sigel, 1963, p. 123).

For the present, since there are no multidimensional measurement procedures available for researching the analytic-global dimension of cognitive style, there seems to be no alternative to using either the Kagan or the Witkin single-criterion tests. In this study the Kagan test was employed. The rationale for this initial choice of a procedure for distinguishing between subjects who were analytical or global stemmed from the fact that a subject's performance on the Kagan criterion is more a matter of his preference than his ability to function analytically. This test examines a subject's performance in a free choice situation. There is no specific answer that is correct. Giving an analytic response on this test is no more difficult than giving a global one. Most subjects, if pressed to do so, can do both At least, so the authors of the test claim (Kagan, Moss, and Sigel, 1963, p. 83).

The reverse seems to be true for the Witkin procedures, where the defining task is a measure of maximum rather than typical behavior. Elliott and McMichael (1963) have clearly shown that even with specific training a subject will not be able to improve his test performance. These investigators screened 44 normal adult subjects on the rod and frame test to form two groups of seven persons who made relatively large errors. One of these groups was given specific instruction on how to resist the influence of the tilted frame and how to use body cues. The other group was given the same training, plus feedback and discussion as they made each judgment. The first group did not improve at all, and the second group showed only a minimal and transient increase of score.

According to authorities in psychological testing, personality variables should be measured in terms of typical and not maximal behavior (Cronbach, 1960, p. 31, Thorndike and Hagen, 1955, p. 21). Since this requirement seemed to be met in the case of the Kagan instrument and not in the case of the Witkin test procedures, the former was chosen as the proper selection instrument for this study.

Considering the serious ambiguity presently attaching to the theoretical conceptualization of the analytic-global construct of cognitive style, Kagan has recommended that current investigations of this construct confine the interpretation of results to the specific operational procedures employed in its measurement. In a similar vein, Witkin has hesitated to expand his use of the term analytic beyond the specific ability to overcome an embedding context. Studies by Jackson (1955), Longnecker (1956), and Karp (1962) have tended to confirm Witkin's caution in this regard. These investigators have found that the field-independent construct does not generalize to situations in which the relevant stimulus is surrounded by distracting stimuli but not embedded in them.

Research Related to the Pervasiveness of a Preference for Analytic-Global Categorizations in Cognitive Functioning

Until recently very few psychologists have given systematic attention to the explanatory potential which individual differences in cognition may possess for furthering knowledge about complex cognitive processes. Bartlett (1932), perhaps, is the outstanding exception. Currently, however, under the heading of the "cognitive controls" which persons use to modulate the expression of motives in their cognitive functioning, a number of investigators have been examining the psychological significance of stable, enduring individual differences in cognition (Klein, 1954, 1956, 1958; Holzman and Klein, 1956, Gardner, Holzman, Klein, Linton, and Spence, 1959).

As a result of this work, various discrete dimensions of consistent individual differences in cognitive functioning have been defined, for example, the selectivity of attention deployment, the habitual extensiveness of scanning under free scanning conditions; the breadth of equivalence range expressed in the categorization of objects, persons, and events; tolerance for unrealistic experiences, and the degree of assimilative interaction among percepts and related memory traces laid down earlier. Gardner and Long (1960) have reviewed this research and concluded that the discovery and calibration of these consistent individual differences supports the soundness "of selecting groups of subjects for experimental studies of learning and remembering that are equal on relevant dimensions of cognitive control" (Gardner and Long, 1960, p. 170). He further states:

> It is our guiding thesis that such complex cognitive behaviors will be fully understood only when both the general laws and the individual laws of learning and remembering are better understood These related approaches to learning, remembering, and other cognitive behaviors meet on common ground: that of the cognitive processes involved in the registration, organization, and later reactivation of that which is learned (Gardner and Long, 1960, p. 170).

The analytic-global dimension of cognitive style, as operationally defined by the CST (Kagan, Moss, and Sigel, 1963), has appeared as one of the most recent attempts to expand understanding of the cognitive processes by studying the controls individual use in experiencing the world. In this respect, the primary investigators of this dimension of cognitive style have also recommended that the analytic-global construct should be used in experimental studies of cognitive processes (Kagan, Moss, and Sigel, 1963; Kagan et al., 1964). The basis for this recommendation, naturally, was the fact that the preliminary investigations of Kagan and his colleagues had demonstrated relationships between their measure of the analytic-global dimension of cognitive style and a variety of cognitive tasks.

The cognitive generality of the analytic-global construct was early noted by the Kagan group in their finding that a child who was analytic on the CST also tended to be analytic in his performance with other test materials that were minimally structured. In testing 21 Fels boys between 7 and 10 years of age, they found a moderate tendency for them to be analytic across a variety of stimulus situations, particularly in the interpretation of ink-blots and in responding to TAT pictures. Typical analytic responses to these materials were: for ink-blots, "That's the face of a beetle, and here are his teeth and jaw," in contrast to the more global response, "That's a bug," for TAT pictures, beginning a story with "There's a gun," in contrast to "That's a robber." (Kagan, Moss, and Sigel, 1963.)

In another study of 6th grade boys and girls, these investigators examined the relationship between analytic scores on the CST and performance on a word association test, a serial learning task, and a figure sorting task. In general, the findings indicated a positive relationship between preferred conceptual style and performance on these tasks. In the word association test a subject was required to give his first association to each of 40 words. Analytic subjects made more noun-noun associations and global subjects more noun-phrase completion responses. This finding was taken as corroborative of the fact that global subjects make more thematic categorizations with the CST stimuli. The serial learning task required subjects to recall words from lists that contained clusters of words grouped on a functional basis (e.g., thunder, lightning, puddle, storm, rain, and windy) or on a categorical basis (e.g., dog, cat, cow, horse, pig, and chicken). During recall trials, analytic subjects tended to recall categorical words continuously to a greater extent than they recalled functional words in clustered series. The reverse was true for global subjects. Lastly, it was found that subjects who were analytic on the CST tended to be analytic in their sorts of human figures. Results on all three cognitive tasks were more consistent for boys than for girls, and since correlations were not particularly high, results had to be interpreted in terms of trends than of specific significant relationships. In a similar study with 3rd graders significant results were found for boys but not for girls. Nonanalytic boys recalled more functionally related words contiguously ($r = .59$, $p < .01$) and gave more noun-verb phrase completions on the word association test ($r = .44$, $p < .05$).

According to Kagan and his colleagues, one factor distinguishing the cognitive task performance of analytic from global children is the tendency for the former to differentiate complex stimulus arrays to a greater degree. Indeed, this is the hypothesis underlying the construction of the CST. These investigators, therefore, have examined the degree to which a subject succeeds in transferring to a discrete part of a stimulus a verbal label that was previously learned as a response to the whole of the stimulus. In testing 50 4th grade children, it was found that analytic children could make this associative transfer with greater success than global children. This finding was later replicated with an independent group of 57 fourth grade boys (Kagan, Moss, and Sigel, 1963).

Lee, Kagan, and Rabson (1963) tested a similar hypothesis with comparable results. These investigators reasoned that differences in cognitive functioning may be due not only to a subject's repertoire of knowledge and the cognitive transformations this knowledge allows him to perform on data, but to the stimulus characteristics of the data to which the subject initially attends and to the categories and labels he first applies to the data. To test this hypothesis, these investigators studied the differences in the rate of learning three kinds of concepts (analytic, relational, and inferential) in a standard concept formation task to see if the learning rate was associated with a preference for making analytic or global groupings on the CST. Thirty 3rd grade boys were used as subjects: 15 had the highest analytic scores and 15 the lowest analytic scores out of a group of 39 children tested with the CST. Using magazine cutouts for stimuli, index cards were prepared which carried the picture of some object on one side of the card and a nonsense syllable on the other side. Stimulus objects which belonged together on an analytic, relational, or inferential basis were paired with the same nonsense syllable. For example, the analytic concept objects with a missing leg" was exemplified by cards with the stimulus objects of a table, a boy, a bird, and so forth, each of them being paired with the same nonsense syllable Each card therefore represented a stimulus-response pair, and the subject s task was to respond to the stimulus picture by naming the nonsense syllable paired with it. The cards were presented with the nonsense syllable covered by a hinged flap, and the subject was required to anticipate which nonsense syllable was under the flap.

The results of this study showed that analytic boys learned two analytic concepts at similar rates (r = .72) and two relational concepts at moderately similar rates (r = .59). The reverse pattern was found for nonanalytic boys: they learned relational concepts at highly similar rates (r = .75) and analytic concepts at moderately similar rates (r = .47). Most importantly, a significant interaction was found between cognitive style and type of concept attained with the greatest success. Analytic boys attained analytic concepts sooner than the other two types of concepts, and nonanalytic boys had their relatively greater success on relational concepts. Inspection of the simple effects from this experiment, however, showed that only in the case of analytic concepts was there a clearly significant difference in the performance of the two groups. For the other types of concepts and in over-all concept attainment neither group was superior. Thus these investigators were able to conclude that cognitive style was an important variable in cognitive functioning whose locus of variability was more in the initial data to which the subject attended than in the various cognitive transformations he might subsequently perform upon the data in arriving at a concept.

The cognitive generality of an analytic-global style, as measured by the CST, has received its most recent support from a series of investigations conducted by Kagan and his colleagues into the immediate and historical determinants of a person's preference for analytical categorization (Kagan _et al._, 1964). These studies were carried out with children in grades 1 through 4, and, in general, the results justified the hypothesis that differences in cognitive style can be expected to manifest themselves in a variety of cognitive tasks. One of the studies reported in this monograph found that a preference for analytic CST responses in 1st and 2nd grade children correlated with the ability to locate familiar figures embedded in a distracting context, with performance on the picture-arrangement sub-test of the WISC but not with performance on the WISC verbal sub-tests (see Wallach, 1962), with the degree of articulation present in responses to ink-blots, and with the tendency to inhibit the impulsive reporting of inaccurate response to both hidden figures and ink-blots.

This series of studies also included a replication of the study on the relation of an analytic attitude to the ability to transfer a verbal label from a total stimulus to one of its differentiated parts. Using 67 4th grade boys as subjects, this study found performances on these tasks to correlate as predicted ($r = .36$, $p < .01$). In all, there were eight studies reported in this monograph, all of them in one way or another demonstrating the "consistency of an analytic attitude across situations" (Kagan et al., 1964, p. 3). Kagan and his colleagues explained this consistency in terms of the more fundamental processes of reflection versus impulsivity and the visual analysis of complex stimulus arrays.

Summary and Implications for the Present Study

The study of cognitive style has advanced to the point where these dimensions of individual differences in cognitive functioning have been recommended as suitable controls in the experimental study of cognitive processes. As stable, pervasive, and self consistent modes of cognitive behavior, cognitive style dimensions are envisioned as the variables directly moderating a person's cognitive activity. This study was designed to see if the analytic-global dimension of cognitive style would significantly affect a person's performance on two cognitive tasks.

One of the chief problems that has attended the investigation of the analytic-global dimension of cognitive style has been the fact that different investigators have employed different measurement procedures to assess this theoretical construct. Kagan and his colleagues have studied this construct in terms of a person's preference for conceptual sorts. Witkin and his colleagues have used a variety of perceptual-motor tasks. In a similar vein, Bruner has discovered problem solving strategies that are more or less analytical depending on the protocols subjects follow in attaining concepts. Although past research has shown that each of these measurement procedures are tapping a theoretical dimension of analytic-global functioning that generalizes across a variety of cognitive situations, it has also cast doubt on the supposition that each of them is sampling that dimension in comparable ways. It has been suggested that analytic-global style may be a multi-faceted dimension and that single-criterion operational measures are inherently incapable of adequately reflecting all aspects of this construct.

Since at present there are no multi-dimensional measures of the analytic-global cognitive style, this study proposed to overcome the inadequacy of the single-criterion measures by measuring the presence of the dimension in terms of one of the single-criterion measures and then studying its effect on cognitive functioning in terms of performance on tasks which have themselves served as single-criterion measures of the analytic-global construct. To this end, the cognitive tasks chosen for study were a concept formation task and an embedded figures task. Both tasks were analytic in nature, and each had potentiality for revealing the degree to which subjects functioned analytically.

The merits of the embedded figures task in this respect have already been sufficiently discussed. The task is _prima facie_ analytical, requiring a subject to disembed a carefully camouflaged simple figure, and a subject's relative quickness in performing the feat is an index of his tendency to be analytical. Concept formation tasks have been used by Bruner (1956) to identify various strategies which subjects may employ in attaining a concept. One of these strategies, _conservative focusing_, is clearly analytic in its style or manner. A subject using this strategy will search for the criterial attributes defining a concept by attending to one attribute at a time, varying its value while holding all other attribute values constant. The task itself is also essentially analytical, requiring as it does that subjects determine which of a set of attributes are criterial to a concept. Thus, this task allows the effect of cognitive style to manifest itself not only in the gross measure of the greater success analytic subjects may be expected to achieve on such an analytic task, but also in the more refined measure of their more frequent and consistent use of a conservative focusing strategy.

With this research design, then, it became possible to see if cognitive style, as measured by the CST, had a pronounced effect not merely on cognitive functioning but on cognitive tasks which would support the theoretical similarity of the construct underlying various separate operational measurements of the analytic-global dimension of cognitive style. If the effect were not pronounced, of course, then the need for increased precision in the theoretical definition of this construct would be underscored.

In addition to the foregoing theoretical considerations involved in the choice of the specific concept formation and perceptual discrimination tasks used in this study, one further general consideration dictated that two tasks of the type chosen be used. The CST requires subjects to produce conceptual categorizations. The actual discriminatory power of the test, however, may lie in the preliminary perceptual discriminations forming the basis of the conceptual categorizations mode (Kagan *et al.*, 1964). Therefore, any examination of the effect of conceptual style as measured by this instrument seemed capable of full exploration only with cognitive tasks that differentially emphasized the perceptual and conceptual components of cognitive activity.

CHAPTER III

EXPERIMENTAL DESIGN OF THE STUDY

The thesis has been advanced that cognitive style is a significant determinant of performance on cognitive tasks. It was the purpose of the present study to examine this thesis in terms of the effect an individual's cognitive style had on facilitating or inhibiting his success in attaining a concept and perceiving an embedded figure under different levels of task orientation and problem difficulty.

On the basis of a preference for making either analytic or global conceptual groupings, individuals were distinguished into splitters, whose cognitive style was analytic, and lumpers, whose style was global. Preference for making these contrasting conceptual groupings was considered the appropriate criterial behavior for measuring differences in a theoretical construct whose underlying notion was style and not proficiency of performance. It was assumed that the Conceptual Style Test, the instrument used in this study to classify subjects as splitters or lumpers, elicited a subject's preferred response among a set of apposite responses, each of which he actually has the ability to make. Support for this assumption was sought by examining the extent to which each item on the test could elicit both types of response from the same individual.

The general hypothesis that cognitive task performance varied as a function of cognitive style, task orientation, and problem difficulty was resolved into the following four specific predictions:

1. Splitters will outperform lumpers on both tasks.

2. Task orientation will improve the performance of both splitters and lumpers on each task.

3. Lumpers will benefit from task orientation to a greater extent than splitters.

4. The differences which have been predicted to obtain between splitters and lumpers will be more evident when problem difficulty level is low than when it is high.

Design of the Research

Data were secured on two cognitive tasks performed under the control of three factors. Two of these factors, cognitive style and preliminary task orientation, were varied between subjects, while the third, problem difficulty, was varied within each subject. Cognitive style was controlled by selecting from a preliminary pool of 120 subjects the 24 subjects with the highest analytic scores and the 24 subjects with the lowest analytic (global) scores on the Conceptual

Style Test. The nature of this test and the scoring procedures used are described in a separate section. Analytic scorers on this test were designated as splitters and global scorers as lumpers.

Within each of these groups subjects were randomly assigned to one of three conditions of preliminary task orientation. Task orientation condition I was a higher level of task orientation than condition II, and task orientation condition III was a control condition in which no orientation was given. The orientation involved demonstration performances of the task and is described at length in connection with the description of the tasks. Using three levels of preliminary task orientation meant that within both the splitter and the lumper groups there were three sub-groups of 8 subjects each arranged as follows:

Each subject performed both the concept formation task and the embedded figures task. For each task there were four problems of varying difficulty. The nature of the tasks and the manner in which task problems were varied for difficulty are explained elsewhere in this chapter. Both the order of tasks and of problems within tasks were randomized for presentation to each subject. The full experimental protocol followed for each subject is shown in Appendix A. The detail of this Appendix is made clear in the sections of this chapter which describe the tasks and the experimental procedures employed.

The Sample

The Conceptual Style Test was administered to 120 8th grade students of the Howard Bishop Junior High School, Gainesville, Florida. The 24 students with the highest analytic scores and the 24 students with the lowest analytic (global) scores were asked to participate in the study. Each student received a dollar for his services and agreed not to discuss any of the procedures until the study was completed. Between the time the Conceptual Style Test was administered and the time the study began, two potential subjects had left school and were not available for examination on the two cognitive tasks. They were replaced with the two students having scores which qualified them as first alternates. All students asked to participate in the study accepted the invitation.

To describe the sample the following information was taken from school records: scholastic ability test scores, scholastic achievement test scores, final 8th grade class scores, and occupation of parent or guardian. These data, together with the sex and age of each subject, are presented in Appendix B.

In both the splitter and the lumper group there were 13 boys and 11 girls. The mean age of both groups was 14-6 years of age, with a standard deviation of 6 months. The groups therefore did not differ with respect to the sex or age of their members. Similarly, there were no significant differences for any of the other descriptive variables. The splitter group had 14 members whose family breadwinner was a skilled or unskilled worker and 10 members where the breadwinner was a professional or business man. The reverse trend existed in the lumper group, in which 15 parents were from the professional or business class with only 9 from the ranks of skilled or unskilled labor. The difference, however, was not significant ($X^2 = 2.08$, df = 1).

The data summarizing the lack of significant difference between the two groups with respect to scholastic ability and achievement are presented in Table 1.

TABLE 1

DESCRIPTION OF SAMPLE
ACCORDING TO SCHOLASTIC ABILITY AND ACHIEVEMENT

Variable	SPLITTERS Mean	SPLITTERS SD	LUMPERS Mean	LUMPERS SD	Mean Difference	*t*
I. Q.	108.38	11.67	105.46	11.63	2.92	.85
CAT Scores*						
Reading	59.19	8.25	59.67	9.43	- .48	.17
Arithmetic	57.29	10.22	60.05	9.24	-2.76	.89
Language	58.14	8.70	60.00	7.93	-1.86	.71
8th Grade Final School Marks						
English	1.59	.80	2.16	1.23	- .57	1.78
Soc. Studies	1.96	.88	2.29	.97	- .33	1.27
Mathematics	2.00	.77	2.39	.94	- .39	1.52
Science	1.69	.80	2.21	1.06	- .52	1.85

*California Achievement Test administered May 1964.

The school record IQ was not considered a particularly valid measure since it was based on a variety of testing instruments administered at different times for each student. In reporting achievement scores, percentiles on the California Achievement Test were converted to normalized McCall T-scores, and 8th grade final marks were converted from letter to point grades.

The Screening Instrument and Selection Procedure

The Conceptual Style Test.--This instrument was devised by Kagan, Moss, and Sigel (1963) to identify those children who consistently differentiate visually presented stimuli and who group familiar objects together on the basis of objective elements of similarity that are parts of a total stimulus. Each item in this test contains three black-and-white drawings of familiar objects, and the child is requested to select two of the drawings that are alike or go together in some way, at the same time stating the reason for his choice. A sample item from this test is presented in Appendix C together with the instructions employed for its administration in this study.

The stimuli represented by the trio of drawings in each item of the Conceptual Style Test were designed to elicit two major classes of responses--analytic and relational conceptual groupings--and, to a lesser degree, inferential-categorical concepts. The analytic conceptual groupings are those based on differentiated, objective parts of the stimuli pairs that allow them to be seen as similar or alike.

Categorizations of this type are: objects with a leg missing; animals with their tongues out, animals with one ear flopped down. In each of these comparisons similarity is based on a differentiated part of the total stimulus; that is, the missing leg, the tongue, the ear.

The relational categorizations involved conceptual pairings on a functional relationship between the total, undifferentiated stimulus objects. The two stimulus members in a relational pairing are not independent but derive their similarity from the relationship between them. For example, relational groupings would include such groupings as: the dog goes in the doghouse, the man wears the watch; the boy wears the glasses.

Inferential categorizations are those which make some inferred quality or abstract dimension of the stimulus-objects the basis for grouping. Examples of this type of categorical grouping are: both objects are articles of clothing or furniture, both are men, both are animals. Such pairings, like the analytic categorizations but unlike the relational, are independent exemplars of the concept upon which the categorization is based.

Scoring.--Kagan, Moss, and Sigel (1963) have found that analytic and relational responses to the items on the Conceptual Style Test are inversely correlated with each other and independent of inferential-categorical responses. The test, moreover, was designed to suppress the occurrence of responses of this latter type. Thus, analytic responses to items on this test can be taken as one end of a continuum whose other end is made up of relational responses, while inferential responses can occur at any point along the continuum, but at a rate of occurrence that allows them to be regarded as inconsequential and irrelevant.

In this study prospective subjects were tested on 19 items from the Conceptual Style Test. Items which elicited an analytic categorization received a score of 1; non-analytic responses, whether they were relational or inferential, were scored as 0. Scores ranged, therefore, from 19 to 0, each person's score indicating the degree to which he had a preference for making analytic categorizations. A low analytic score, in accordance with the findings of Kagan and his colleagues, was taken to represent the inverse preference for making global categorizations.

Administration.--In employing the Conceptual Style Test to select the sample for this study, two administrations of the test were held. The first administration followed the standard instructions prescribed by the test authors, with the one modification that subjects were instructed to answer on the separate answer sheets provided instead of answering in the test booklet itself. Upon completion of the first administration of the test, answer sheets were taken up and new ones distributed. Subjects were then asked to take the test again under instructions which requested them to see if they could find some other way in which the drawings in some or all of the items could be paired.

The purpose of the two administrations of the test was to measure the extent to which it was within a subject's ability to give either an analytic or a non-analytic response. The test authors have reported that few children are incapable of giving alternate responses when called upon to do so. It was this preferential, non-ability aspect of the test which recommended its use in this study as the instrument for identifying subjects with differing cognitive styles. The double administration of the test was an attempt to verify this presupposition about the elective nature of the task involved in this test of cognitive style.

Testing took place during regular class study periods. For each class goup tested, both administrations of the test were held during the same class period. Subjects were selected for participation in the study solely on the basis of their scores on the first administration of the test. No subject serving in the splitter group made less than a score of 17 on the Conceptual Style Test, and no subject in the lumper group more than a score of 6. The results from this first administration of the test are summarized in Table 2.

TABLE 2

GROUP MEAN SCORES ON THE SCREENING ADMINISTRATION
OF THE CONCEPTUAL STYLE TEST

Group	N	Mean	Standard Deviation	F
ALL STUDENTS	120	11.59	5.26	
Splitters	24	17.83	.87	
Lumpers	24	4.08	1.74	
Non-subjects	72	12.01	3.57	135.5*

$^*p < .01$ (2, 117)

The distribution of scores on the Conceptual Style Test was such that the two groups of 24 students in the tails of the distribution differed significantly in mean score not only from each other but from the residual non-subject group of 72 students as well. The over all F for mean differences was 135.2 ($p < .01$; df = 2,117) The procedure used for testing the significance of differences between the three individual pairs of means was that recommended by Winer (1962, p. 100) for use with unequal sample sizes. The mean difference between the Splitter and Lumper group was 13.75 (F = 12.3, $p < .01$, df = 1, 117), between the Lumper and non-subject group 7.93 (F = 6.90; $p < .01$, df = 1, 117); and between the Splittor and non-subject group 5.82 (F = 5.13; $p < .05$, df = 1, 117).

The Conceptual Style Test scores made by students selected for participation in this study were subjected to an inter-scorer reliability check by having a second scorer independently evaluate the responses given by 12 of the splitters and 12 of the lumpers. In this second analysis of the 456 item responses involved there was disagreement on only 3 items. In no case did these minimal disagreements result in a score change that would have disqualified the student as a subject for this study.

Experimental Procedures

On the basis of his score on the Conceptual Style Test each subject was designated as either a splitter or a lumper and randomly assigned to one of the three task orientation conditions. This identification and assignment process was carried out by an aide of the experimenter, with the result that the experimenter did not know whether a subject he was testing was a splitter or a lumper. He only knew that the subject was to be tested under a particular task orientation condition.

The experimental testing sessions in which subjects were individually tested on the concept attainment task and the embedded figures perception task were held in a small seminar room adjacent to the main reading room of the Howard Bishop school library. This arrangement provided a maximum of privacy and quiet during testing.

For each subject a problem order protocol was worked out in advance. This protocol included a randomization of the sequence in which the concept attainment task and the embedded figures task was to be performed, as well as the randomization of problems within each task. The protocol for each subject has been presented in Appendix A. Task performance record sheets were kept for each subject, and Appendix B contains a completed sample of these records.

Both experimental tasks were administered during the same test session. Test sessions lasted from 40 to 90 minutes, the actual test time depending on the ability of the subject and the preliminary task orientation condition to which he was assigned.

The concept attainment task. This task represented a modification of the Bruner (1956) experimental procedure for testing a subject's ability and strategy for finding the criterial attributes which conjunctively define a class or category of objects existing within the universe of all such objects. For the purposes of this study, a universe of 2^5, or 32, objects was generated by creating an object possessed of 5 attributes, each attribute having two possible values.

From this universe of 5-attribute objects a finite number of sub-sets can be defined simply by designating as criterial one or the other values of one or more of the 5 attributes. Thus, a concept in these terms would be equivalent to the particular attribute value(s) from the information that specific objects are or are not members of that class or sub-set.

To make this study's concept attainment task interesting to young adolescents, a cartoon-like geometric "cat" was chosen as the object. The universe of these cats is shown in Appendix E. The five attributes of these cats and the two values each attribute may take are as follows:

Attribute	Values	
Shape of Head	1. Circle (C)	2. Square (S)
Shape of Body	1. Rectangle (R)	2. Triangle (T)
Color of Cat	1. Black (B)	2. Green (G)
Number of Whiskers	1. Two (2)	2. Three (3)
Position of Tail	1. Points Right (Rp)	2. Points Left (Lp)

An example of a sub-set of cats drawn from this particular universe of cats would be the 4 cats comprising the first vertical column in the array of 32 shown in Appendix E. The concept defined by these 4 instances or exemplars is a black cat, with a rectangular body and a tail pointing right. In other words, these are the 3 values of the 3 attributes which are criterial to this particular sub-set. No other cat in the universe is a member of this sub-set, because no other cat possesses conjunctively the features to make it a black, rectangular-bodied, right-tailed cat.

Those attributes whose values are not criterial to a particular concept—shape of head and number of whiskers in the example given—are referred to as noisy attributes. It is obvious that the size of a particular sub-set or class of cats will vary with the ratio of criterial to noisy attributes. This ratio determines the number of positive or negative instances which a specific concept possesses. Since Bruner's research (1956, p. 63) demonstrated that subjects experience less cognitive strain in dealing with positive instances of concepts, it was assumed that criterial noisy attribute ratios which increased the number of positive instances of a concept would make that concept easier to attain.

Bruner (1956, p. 83) has also identified various ideal strategies which subjects employ, more or less imperfectly, in the solution of concept attainment tasks. One such strategy, conservative focusing, is essentially an analytical approach in which a subject first differentiates the values of each attribute contained in a positive instance and then proceeds to find the concept by focusing on the effect of changing the values of these attributes one at a time, while holding constant the values of all other attributes.

To measure the concept attainment ability of subjects and their preference for using a conservative focusing strategy, four concept attainment problems were given to each subject under a protocol which allowed him to keep the universe of objects in sight during problem time and to control the selection of instances he wished to examine.

The pre-task instructions describing the manner in which this task was carried out with each subject are presented in Appendix F.

Each of the 4 problems presented to a subject represented a different ratio of noisy to criterial attributes. The selection of the criterial attribute value(s) for each problem was randomized in order to control the effect of attribute value on the criterial-noisy attribute ratio of problems. The order in which the 4 problems with their different criterial-noisy attribute ratios were presented to each subject was also randomized so that the effect of this ratio on subject performance could be analyzed apart from any sequence or order effect. The concepts which each subject received under this double randomization procedure may be found in Appendix A.

A warm-up problem was given to each subject to acquaint him with the task and the procedures to be followed in attaining a concept. The concept to be attained in this trial problem was a randomly selected one-attribute concept.

Following practice on the trial problem, subjects were differentially oriented toward employing a conservative focusing strategy in concept attainment. Task orientation consisted of having the experimenter demonstrate the conservative focusing strategy. The experimenter did not explain how he attained the concept, but simply showed the subject that a concept could be attained systematically and with a minimum selection of instances. This was accomplished by having a prearranged set of concepts from which the subject could select one at random without allowing the experimenter to see it. Each of these concepts had listed with it the number of one of the cats which was a positive instance or exemplar. The subject was instructed to tell the experimenter the number of the cat. The experimenter then proceeded to ask the subject about the positive or negative status of the other cats which a conservative focusing strategy required to be examined. In this way the experimenter was able to tell the subject what the concept was in a maximum of 5 instances examined. The following protocol illustrates this procedure.

Concept: G S Rp

Exemplar: G R S 2 Rp (Cat No. 29)

S s Selections:	B R S 2 Rp (Cat No. 25)	Negative instance
	G T S 2 Rp (Cat No. 31)	Positive instance
	G T O 2 Rp (Cat No. 15)	Negative instance
	G T S 3 Rp (Cat No. 23)	Positive instance
	G T S 3 Lp (Cat No. 24)	Negative instance

Hypothesis: G S Rp

On the basis of the 5 selections examined it became evident that the concept was GSRp since a change in each of these attribute values and only these was sufficient to make the instance negative.

The three conditions of task orientation were determined by the number of such demonstrations given to a subject. Four demonstrations were given to subjects in condition I; two to those in condition II, and none to the control subjects in condition III.

Scoring.--The measure of a subject's concept attainment ability was the time he took to discover the criterial attribute value(s) of a concept. The maximum time allowed any subject on a particular problem was 10 minutes. If the subject had not attained the concept within that time limit, he was told what the concept was and the next problem was begun

For the purposes of this study it was also desirable to derive for each subject a concept attainment strategy score. This was done by examining the instances a subject selected for inspection. A conservative focusing strategy required that for each new selection only one attribute value be varied, all others being held constant. The instances selected by each subject up to the point where he made his first statement of what he thought the concept was were examined and scored 1, 2, 3, etc. according to the number of attribute values changed in each selection. These scores were summed and divided by the number of selections made to give a subject his strategy score. A perfect conservative focusing score would, of course, be 1 00. To the extent that scores were larger than this ratio of unity, a subject had departed from a conservative focusing approach in attempting to attain the concept. In this scoring procedure provision was made for discounting those changes which were rendered inconsequential because previous selections had shown the attribute to be noisy or non-criterial.

Since Lee, Kagan, and Rabson (1963) have shown that analytic and global subjects can differ in their ability to attain particular types of concepts and yet not differ in their over all concept attainment ability, the strategy score was considered an important additional measure to be considered in the study.

Similarly, because Kagan and his colleagues (1963, 1964) have found that analytic and global subjects differ in their cognitive impulsiveness, a third measure of concept attainment performance was taken on the subjects of this study. This score was the number of instances a subject selected for examination before he made his first statement of what he thought the concept was. These latter two scores then were the measures which described a subject s style of concept attainment as distinct from his ability to attain a concept. As such, they represented additional important measures of subject performance on the concept attainment task.

The embedded figures perception task.—This task required a subject to find a simple figure embedded in a complex one. The embedded figures employed in this study were the Gottschaldt figures used by Thurstone (1944) in his factorial study of perception. Parts I through IV of this test represented the four problems given subjects on this task. Thurstone's study revealed that Part I and II of this test were significantly easier than Part III and IV. The latter two parts of the test had embedding contexts of much greater complexity. In this study, to vary further the difficulty of the four parts of Thurstone-Gottschaldt figures, Parts II and III were administered in such fashion that the simple figures being sought by the subjects were not visually available during problem time. These four parts of the Thurstone-Gottschaldt test are presented in Appendix G, together with Part V of this same test. Part V was used in this study in connection with the task orientation given subjects.

The sequence in which the four tests were presented to each subject was randomized, thereby making it possible to examine the performance of subjects on the different tests apart from any order of sequence effects. Appendix A presents the order in which each subject was tested on these four tests.

Task orientation on the embedded figures task consisted of demonstrating to subjects the part-isolating versus the whole-perceiving approach recommended by Benussi (Woodworth and Scholsberg, 1954) as helpful in performing such perceptual tasks. In the course of this demonstration subjects were shown the various methods used in embedding simple figures in more complex ones. These methods were: (1) prolonging the lines which form a prominent corner of the contour of the simple figure; (2) placing other lines out beyond the flat ends of the simple figure, (3) drawing lines across the interior space of the simple figure, (4) adding lines which change the dimensional figure or vice versa; (5) skewing an originally symmetrical simple figure.

In Part V of the Thurstone-Gottschaldt Test there were ten examples of embedded figures available for task orientation. In task orientation condition I, the experimenter showed subjects how to use the above information to locate the simple figure concealed in each of the ten complex figures. In task orientation condition II the demonstration was limited to the first five of these complex figures. Task orientation condition III, of course, was the control condition in which no orientation was given.

Scoring.--The score used to measure performance on the embedded figures test was the rate at which figures were correctly disembedded under minimum time limits. Time limits varied for the different parts of the test and were those recommended by Thurstone (1944), namely, two minutes for Part I, one minute for Part II, four minutes for Part III, and three minutes for Part IV.

Treatment of Data

The data collected for this study pertained, in the first place, to the assumption that responses on the Conceptual Style Test are more a matter of preference than ability. Support for this assumption was sought by examining differences between the scores subjects make when they are given the standard instructions and the scores they make when they are instructed to find additional conceptual categorizations.

In the second place, data were collected to test the basic hypothesis that cognitive task performance will vary as a function of cognitive style, task orientation, and problem difficulty. The effects of these factors and their interactions were studied by the analysis of variance. The factor of problem difficulty was varied within each subject, while the other two factors were varied between subjects. In addition to the performance scores for the two tasks studied, the concept attainment yielded two additional style scores which were used to examine the effects of the general factors and their interactions.

The majority of the computations performed on the data were carried out with the assistance of the IBM 709 computer at the University of Florida Computing Center.

CHAPTER IV

ANALYSIS OF THE DATA

This research was designed to examine the effect of cognitive style on cognitive task performance. The specific cognitive style dimension investigated was the analytic-global construct, as operationally defined by the Conceptual Style Test (CST). Scores on this test have been assumed to represent an individual's preference for making either analytic or global conceptual groupings.

The major objective of the study was met by determining the extent to which analytic and global subjects differed in their ability to attain concepts and perceive embedded figures. For both of these cognitive tasks the performance of subjects was investigated under conditions which exercised control over the factors of problem difficulty and preliminary task orientation.

This chapter presents the analysis of the data gathered in the investigation. The findings are presented first and then discussed in terms of their implications for the hypothesis being studied

Performance on the Conceptual Style Test

To substantiate the assumption that performance on the CST represented an individual's preference for making analytic or global conceptual groupings and not his ability to make one or the other, the students screened for participation in this study were given the test twice. The first administration of the test was held under the standard instructions, while the second administration instructed the students to find other ways in which two of the three drawings in each item were alike or went together. The test, it will be recalled from Chapter III, was scored in such fashion that analytic scorers fell at the high end of the scoring range and global scorers at the low end, the range of all possible scores being 10 to 0. Table 3 shows the bivariate frequency distribution of the scores made by the 120 students screened, when scores were grouped into five equal intervals.

Inspection of Table 3 shows that students who scored within any particular score interval on the first administration of the test had scores on the second test administration that spread fairly evenly across all score intervals. The Pearson product-moment correlation coefficient for the two test administrations was -.048. This indicated that when students were instructed to give alternate responses to the items on the CST, they generally gave responses of a kind that

TABLE 3

BIVARIATE FREQUENCY DISTRIBUTION OF SCORES ATTAINED
BY 120 STUDENTS TAKING THE CONCEPTUAL STYLE TEST TWICE

Score Intervals	0-3	4-7	8-11	12-15	16-19	Test II Totals
16-19	1	3	1	3	6	79
12-15	2	6	5	7	6	26
8-11	2	11	5	8	8	34
4-7	2	3	6	11	9	31
0-3	3	2	0	4	6	15
Test I Totals	10	25	17	33	35	120

represented a change from an analytic to a global response or vice versa. The frequency distribution, together with group means and standard deviations, of such response changes for the splitter, lumper, and non-subject groups is presented in Table 4.

TABLE 4

RESPONSE CHANGES ACROSS TWO ADMINISTRATIONS OF THE CONCEPTUAL STYLE TEST

Number of items receiving both analytic and global responses	Splitters N = 24	Lumpers N = 24	Non-Subjects N = 72	All Subjects N = 120
16-19	3	5	12	20
12-15	10	10	29	49
8-11	4	1	20	25
4-7	4	6	7	17
0-3	3	2	4	9
Mean	10.5	10.75	11.48	11.14
S. D.	6.59	5.58	3.74	4.21
F-ratio			.62	

On the average, students gave both analytic and global responses to more than half the items. This was true whether a student's score on the initial test classified him as a splitter, lumper, or non-subject. Thus, at least half of a subject's total score on the CST may be considered the result of responses which were made as a matter of preference and not ability.

The Attainment of Concepts

Three measures were taken of performance on the concept attainment task. One, time on task, was a measure of a subject's ability to attain concepts, and the other two, the conservative focusing strategy score and the number of instances examined prior to the first answer given to a concept problem, were measures of a subject's manner or style of concept attainment. The effects of the three factors of cognitive style, task orientation, and problem difficulty were examined in terms of each of these scores.

Time on task

Appendix H shows the time taken by each subject to attain each of the four concept attainment problems attempted. Time on task was used as the measure of ability since it was anticipated that some concepts would not be attained. A maximum of 10 minutes was allowed each subject on each concept attainment problem. Preliminary testing indicated that subjects who were going to be successful in attaining a concept would do so within that time limit. Where Appendix H indicates that a subject took ten minutes on the concept attainment problem, the concept was not attained. To verify the validity of using time on task as the measure of ability in attaining concepts, the average time taken by each subject on all four concept problems was correlated with the number of concepts actually attained. The Pearson product-moment correlation between these measures was .84, which seemed to be large enough to justify using time on task as the measure of ability.

Subjects were tested on a total of 192 concepts and succeeded in attaining 141 Of this number, 73 were attained by lumpers and 68 by splitters Only one subject failed to attain at least one concept. Mean concept attainment times for the two cognitive style groups and the three task orientation subgroups for each of the four concept attainment problems are presented in Table 5.

The results of the analysis of variance performed on the group mean time scores to determine the effect on concept attainment of the three factors of cognitive style, task orientation, and problem difficulty level, together with their interactions, are presented in Table 6.

TABLE 5

MEAN CONCEPT ATTAINMENT TIMES (IN MINUTES)
FOR SPLITTERS AND LUMPERS TESTED ON FOUR CONCEPTS
UNDER THREE CONDITIONS OF TASK ORIENTATION

Group	CONCEPTS Number of Criterial Attributes 1	2	3	4	Group Average
SPLITTERS	3.80	5.89	7.00	6.43	5.78
High Orientation	4.28	6.40	7.88	6.47	6.25
Low Orientation	4.49	5.65	7.93	7.36	6.35
No Orientation	2.67	5.61	5.89	5.44	4.73
LUMPERS	3.90	5.89	5.44	5.74	5.24
High Orientation	2.27	4.25	3.76	4.67	3.73
Low Orientation	4.86	7.74	7.67	6.71	6.74
No Orientation	4.57	5.69	4.90	5.83	5.25
TOTAL SAMPLE	3.85	5.88	6.22	6.08	5.51

TABLE 6

ANALYSIS OF VARIANCE SUMMARY TABLE OF TIME SCORES ON THE CONCEPT ATTAINMENT TASK

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Square	F-ratio
Between Subjects				
Cognitive Style	1	13.8514	13.8514	.997
Task Orientation	2	103.3513	51.7564	3.725*
Style X Orient	2	93.7515	46.8758	3.374*
Error (b)	42	583.5682	13.9845	
Within Subjects				
Problem Difficulty	3	179.0039	59.6679	5.84.**
Style X Difficulty	3	21.0774	7.0258	.688
Orient X Diff	6	16.2319	2.7053	.265
Style X Orient Diff	6	21.5299	3.5883	.351
Error (w)	126	1287.1566	10.2155	
TOTAL VARIATION	191	2319.6833		

* $p < .05$
** $p < .01$

As the analysis reported in Table 6 shows, the factor of cognitive style did not have a significant effect on the time scores for the concept attainment task. It should be noted, however, that lumpers had an overall mean score that was lower, and therefore reflective of better performance, than the mean score attained by the splitters. The factor of task orientation, on the other hand, did significantly affect concept attainment time. The significant interaction of this factor with cognitive style, however, indicated that the effect of task orientation was dissimilar for the two style groups.

When individual mean differences were examined using the Newman-Keuls range test (Winer, 1962, p. 309), it was found that there was no significant difference among the group means attained by the three groups of splitters performing under differing conditions of task orientation. The trend, however, indicated that the task orientation conditions resulted in poorer mean scores than the no orientation condition. For the lumpers, subjects in the high task orientation condition had a significantly better mean performance time than subjects in the low task orientation condition ($p < .01$). The subjects in the high task orientation condition also had a better mean performance time score than the subjects in the no task orientation condition, but the difference was not significant. Nor was the better mean performance score of the no task orientation group relative to the low orientation group significant.

Examining differences between lumpers and splitters for each condition of task orientation revealed that only the difference in the high task orientation condition was significant ($F = 7.25$, $df = 1, 42$; $p < .05$).

For both style groups, at all levels of task orientation, problem difficulty was a significant factor. The Newman-Keuls range test indicated that concepts with only one attribute criterial were attained significantly sooner than concepts with two or more attributes criterial, the difference being significant at the .05 level of significance. Mean problem concept attainment times for concepts having two or more attributes criterial did not differ significantly among themselves. In effect, this meant that for this sample there were two levels of problem difficulty.

Conservative focusing strategy scores

As explained in Chapter III, a measure was taken of the extent to which subjects employed a conservative focusing strategy in attempting to attain a concept. The strategy scores for each subject are presented in Appendix I. In 60 of the 192 concept problems, subjects attained a perfect conservative focusing strategy score of 1.00. The maximum departure from this strategy was found to be a score of 2.66.

Mean strategy scores for the two cognitive style groups, under the three conditions of task orientation for each of the four concept attainment problems, are presented in Table 7. The overall mean difference between splitters and lumpers was a negligible .02

TABLE 7

MEAN CONSERVATIVE FOCUSING STRATEGY SCORES ATTAINED BY SPLITTERS AND LUMPERS TESTED ON FOUR CONCEPTS UNDER THREE CONDITIONS OF TASK ORIENTATION

Group	CONCEPTS Number of Criterial Attributes 1	 2	 3	 4	Group Average
SPLITTERS	1.26	1.36	1.45	1.25	1.33
High Orientation	1.29	1.45	1.41	1.21	1.34
Low Orientation	1.30	1.60	1.60	1.26	1.44
No Orientation	1.18	1.03	1.32	1.28	1.20
LUMPERS	1.26	1.26	1.39	1.35	1.31
High Orientation	1.18	1.15	1.31	1.33	1.24
Low Orientation	1.26	1.30	1.53	1.38	1.37
No Orientation	1.33	1.32	1.32	1.33	1.33
TOTAL SAMPLE	1.26	1.31	1.42	1.30	1.32

Inspection of Table 7 shows that as a whole the subjects in the study adhered closely to a conservative focusing strategy. This finding was in contrast to Atkinson's finding that 9th grade children tend to favor a strategy (focus gambling) in which more than one attribute value is varied at a time (Atkinson, 1964).

The difference in these findings may have been due to the different object universes used in the two studies. Atkinson used the Bruner object which had three values for each of four attributes. This generated a universe of 81 objects, which was much larger than the 32 object universe used in this study. If this difference in object complexity and size of universe was the reason for the different strategies followed, then there is reason to believe that a person's performance on a cognitive task may vary more with the nature of the task than with the personality predispositions of the subject. This interpretation, moreover, would be in conformity with Bruner's general finding that subjects vary their concept attainment strategies in response to changes in the degree of cognitive strain imposed by task performance conditions (Bruner, 1956, p. 112).

Although the magnitude of the group mean differences presented in Table 7 was not of such an order as to lead to the expectation that any of the factors or their interactions would prove significant, an analysis of variance was performed on the conservative focusing scores to verify this expectation. The results of this analysis are presented in Table 8.

TABLE 8

ANALYSIS OF VARIANCE SUMMARY TABLE
OF STRATEGY SCORES ON THE CONCEPT ATTAINMENT TASK

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Square	F-ratio
Between Subjects				
Cognitive Style	1	.0114	.0114	.079
Task Orientation	2	.7061	.3526	2.455
Style X Orientation	2	.4642	.2321	1.616
Error (b)	42	6.0323	.1436	
Within Subjects				
Problem Difficulty	3	.6648	.2216	1.967
Style X Difficulty	3	.2472	.0824	732
Orient X Diff	6	.5056	.0843	.748
Style X Orient X Diff	6	.6485	.1081	.959
Error (w)	126	14.1940	.1127	
TOTAL VARIATION	191	23.4733		

As the F-ratios from Table 8 indicate, none of the factors or interactions had a significant effect on the tendency of subjects to employ a conservative focusing strategy.

Number of instances examined by a subject before he gave his first answer to a concept problem

As a measure of the impulsiveness with which a subject concluded he had discovered the concept he was seeking, a count was made of the number of instances a subject examined before he gave his first answer to a concept attainment problem. Appendix J presents this figure for

TABLE 9

MEAN NUMBER OF INSTANCES EXAMINED PRIOR TO THE FIRST ANSWER GIVEN BY SPLITTERS AND LUMPERS TESTED ON FOUR CONCEPTS UNDER THREE LEVELS OF TASK ORIENTATION

Group	CONCEPTS Number of Criterial Attributes 1	2	3	4	Group Average
SPLITTERS	3.88	3.71	4.92	5.25	4.44
High Orientation	3.63	3.88	4.63	3.38	3.88
Low Orientation	4.13	4.50	6.88	6.88	5.59
No Orientation	3.88	2.75	3.25	5.50	3.84
LUMPERS	4.38	4.96	5.54	5.50	5.09
High Orientation	4.13	3.88	6.13	5.63	4.94
Low Orientation	4.38	7.25	4.75	5.75	5.53
No Orientation	4.63	3.75	5.75	5.13	4.81
TOTAL SAMPLE	4.13	4.33	5.23	5.38	4.77

the four problems attempted by each subject. Scores ranged from a minimum of one to a maximum of 19. The modal score was four. Mean scores on this measure for the two cognitive style groups tested on four concepts under three conditions of task orientation are presented in Table 9, and Table 10 summarizes the results of the analysis of variance performed on this measure.

TABLE 10

ANALYSIS OF VARIANCE SUMMARY TABLE OF INSTANCES EXAMINED BY SUBJECTS PRIOR TO GIVING A FIRST ANSWER TO A CONCEPT PROBLEM

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Square	F-ratio
Between Subjects				
Cognitive Style	1	20.67	20.67	1.802
Task Orientation	2	61.16'	30.58	2.665
Style X Orientation	2	12.47	6.23	.543
Error (b)	42	481.91	11.47	
Within Subjects				
Problem Difficulty	3	56.81	18.94	2.694*
Style X Difficulty	3	6.52	2.17	.309
Orient X Diff	6	41.18	6.86	.976
Style X Orient X Diff	6	76.03	12.67	1.803
Error (w)	128	885.72	7.03	
TOTAL VARIATION	191	1642.45		

* $p < .05$

As Table 10 shows, only the factor of problem difficulty was significant. Inspection of the total sample means for the four concept problems (see Table 9) showed that subjects tended to examine more instances as the number of criterial attributes was increased. This finding was consistent with Bruner's data on the reluctance of subjects to draw conclusions from negative instances, preferring instead to double check the information in a negative instance by seeking confirmation from a redundant examination of a positive instance (Bruner, 1956, p. 94). Since the number of negative instances extant in the universe of objects goes up with the number of attributes criterial to a concept, the number of redundant choices should also go up with an increase in the number of criterial attributes. In general, this happened for the total sample in this study. The trend, however, was not reproduced for every sub group (see means in Table 9). The triple interaction (Style X Orientation X Difficulty), while not significant, was nevertheless large. This finding suggested that the trend evident in the total sample means should not be generalized across the sample, but examined separately for both style groups in each of the task orientation conditions.

The Perception of Embedded Figures

The measure taken of performance on the Embedded Figures Task was the rate at which subjects disembedded figures under a minimum time limit.

Scores were computed in terms of the number of figures disembedded per minute of time. Appendix K presents the scores attained by each subject on the four parts of the Embedded Figures Test. As explained in Chapter III, Parts III and IV of this test contained the Gottschaldt figures which Thurstone (1944, p. 72) had found to be more complex and difficult than the figures in Parts I and II. In this study an attempt was made to vary the difficulty level of the test parts further by having subjects attempt Parts II and IV under the restriction that they could not visually refer back to the simple embedded figure(s) they had been shown and instructed to find in the more complex embedding figures.

The distribution of the rate scores attained by subjects on the four parts of the Embedded Figures Test lacked the requisite homogeneity to permit their use in an analysis of variance. A square root transformation was performed on each score, and the analysis was undertaken with the scores thus obtained. The transformed scores were also used to compute the mean rate scores attained by the two cognitive style groups tested on the four parts of the test under the three conditions of task orientation given subjects. These mean rate scores are presented in Table 11.

The results of the analysis of variance performed on the transformed rate scores are presented in Table 12. This analysis takes into account the fact that tests were varied for difficulty level on two factors, visual availability of the embedded figure during problem time and complexity of the embedding figure.

TABLE 11

MEAN RATE SCORES (NUMBER OF FIGURES DISEMBEDDED PER MINUTE) FOR SPLITTERS AND LUMPERS TESTED ON FOUR SETS OF FIGURES UNDER THREE CONDITIONS OF TASK ORIENTATION

Group	EMBEDDED FIGURES TEST Part I	Part II	Part III	Part IV	Group Average
SPLITTERS	2.65	2.24	1.24	1.32	1.89
High Orientation	2.44	1.94	1.23	1.37	1.75
Low Orientation	2.94	2.49	1.21	1.75	2.06
No Orientation	2.38	2.28	1.53	1.48	1.86
LUMPERS	2.34	2.18	1.14	1.42	1.77
High Orientation	2.24	2.13	1.19	1.49	1.76
Low Orientation	2.22	2.03	1.10	1.41	1.69
No Orientation	2.56	2.37	1.11	1.35	1.85
TOTAL SAMPLE	2.44	2.21	1.16	1.47	1.83

TABLE 12

ANALYSIS OF VARIANCE SUMMARY TABLE
OF RATE SCORES ON EMBEDDED FIGURES TASK

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Square	F-ratio
Between Subjects				
Cognitive Style	1	.7032	.7032	1.586
Task Orientation	2	.8308	.4154	.943
Style X Orientation	2	1.2021	.6011	1.356
Error (b)	42	18.6292	.4436	
Within Subjects				
Figure Availability	1	.0315	.0315	.200
Style X Availability	1	.0729	.0729	.463
Orient X Availability	2	.1130	.0565	.359
Style X Orient X Avail	2	.2407	.1203	.765
Error	42	6.6064	.1573	
Problem Complexity	1	47.8201	47.8201	187.016*
Style X Complexity	1	.0189	.0189	.074
Orient X Complexity	2	.4880	.2440	.954
Style X Orient X Compl	2	.6833	.3416	1.336
Error	42	10.7422	.2557	
Availability X Complexity	1	3.2709	3.2709	19.836*
Avail X Compl X Style	1	.0697	.0697	.423
Orient X Avail X Compl	2	.1735	.0867	.526
Style X Or X Avail X Compl	2	.1239	.0619	.375
Error	42	6.9289	.1649	
TOTAL VARIATION	191	98.7512		

* $\underline{p} < .01$

The factor of problem complexity accounted for almost half the total variability in the scores and yielded an F ratio of 187.02 ($p < .01$). This result confirmed Thurstone's findings that the complex figures in Parts III and IV of the test were more difficult than the simple figures in Parts I and II. The significance of this factor was further substantiated when individual comparisons were made among the Total Sample means for the four parts of the test. The Newman-Keuls range test showed that the means for Parts I and II belonged to one population of means, and the means for Parts III and IV to another.

The significant interaction between Visual Availability of the embedded figure and Complexity of the embedding figure indicated that concealing the problem figure(s) during task time produced contrary results in the less difficult (Parts I and II) and the more difficult (Parts III and IV) parts of the test. In the latter parts of the test the concealed figures were found more rapidly, while in the former parts they were found less rapidly. Concealing the problem figure(s) on two parts of the test, then, may actually have decreased rather than increased performance differences on the several parts of the test.

Other than the differences related to the factor of problem complexity there were no significant differences in the performance of subjects on the Embedded Figures Test.

Discussion

In general, the data failed to support the hypothesis that cognitive style is a significant determinant of cognitive task performance.

To a limited extent, task performance did vary as a function of preliminary task orientation and problem difficulty level; but not, for the most part, in the manner predicted. These general findings will be discussed in the light of the four specific predictions made in this study.

It should be recalled at this point that the sample of splitters and lumpers selected for investigation in this study did not differ in scholastic aptitude, school achievement, or social background. Neither did they differ in age, school grade, or sex. Furthermore, they were comparable in giving evidence that their responses on the CST were a function of personal preference for making a conceptual categorization and not of ability to make only one or the other type of categorization.

Prediction 1

Splitters will outperform lumpers on both tasks. The rationale for this prediction was the apparent analytic nature of both tasks. This prompted the expectation that they would be performed more easily by splitters, that is, by subjects identified through the CST as having a mental set or personal predisposition for making analytical groupings in a free choice situation. It was also thought that time measures would be particularly sensitive to whatever task performance advantage an analytic cognitive style gave splitters.

The results of the study did not support this prediction. Overall performance differences between splitters and lumpers on each task were slight and non-significant. These findings were considered particularly damaging to the general hypothesis that cognitive style is an important determinant of cognitive functioning. As Wallach (1962) has pointed out, the validity of any style construct requires that it have noticeable generality across a variety of cognitive tasks. The subjects in this study clearly differed on the analytic-global style dimension operationally defined by the CST, yet this style difference had no distinguishable effect on their ability to perform two cognitive tasks whose analytical value should have favored analytical subjects if style differences are really predictive of task performance.

Since the ability to perceive embedded figures has been used by Witkin as another operational measure of the analytic-global construct, the lack of difference on this task was particularly noteworthy. The lack of performance differences on the concept attainment task was less surprising. The task did not place the same emphasis on perceptual factors as did the embedded figures test, since the problem was not to see the attributes in an instance but to determine their relevance or irrelevance. In view of the fact that Kagan and his colleagues believed that performance differences on the CST are largely a function of perceptual factors, it was not expected that splitters would outperform lumpers as decisively on the concept attainment task as on the embedded figures task. For this reason, two other measures which the investigator thought might be more sensitive to the differences in style measured by the CST were taken on the concept attainment task: namely, the degree to which subjects followed a conservative focusing strategy, and the number of instances subjects chose to examine before committing themselves to a first response on a concept problem.

Bruner (1956) has shown the conservative focusing strategy to be one that succeeds because one attribute is focused on to the exclusion of the others. This suggested that splitters who prefer to notice similarity of object parts and neglect the possibility of relationships between whole objects might also be more predisposed to follow a conservative focusing strategy in concept attainment.

In their recent work, Kagan and his colleagues (1964) have presented evidence that in addition to differences in perceptual focus, splitters are inclined to be less impulsive than lumpers in performing cognitive tasks. That is, they reflect longer before giving answers. It seemed plausible, therefore, in this study to score the number of instances a subject chose to examine before he committed himself to his first response on the concept attainment problems as a way of measuring the extent to which a subject gave responses impulsively and unreflectively.

Differences between splitters and lumpers on these two additional performance measures were, however, equally inconsequential. Overall strategy differences were negligible, and lumpers actually inspected more instances before making a first response than splitters. Of the two measures, the conservative focusing strategy scores yielded findings more in line with the predicted outcome than did the other measure. In the no task orientation condition splitters did employ a conservative focusing strategy to a greater extent than lumpers. The difference, however, was far from statistically significant. In the same no task orientation condition, on the other hand, lumpers examined more instances before making a first response to a concept problem than did splitters Again, the difference was not statistically significant. The no task orientation condition, it should be understood, is the more relevant of the orientation conditions for considering the implications of results for Prediction 1 because the findings were free from interaction effects with experimental task orientation treatments.

Since the analyses of variance performed on the strategy scores and the scores representing number of instances to a first answer indicated that none of the factors or interactions relevant to the predictions made in this study were significant, it was considered unnecessary to discuss these scores further in the interpretation of the findings. Their major significance resided in showing that cognitive style differences failed to manifest themselves not only in performance scores but in style or manner of performance measures of the concept attainment task.

In summary, then, little evidence was found in this study for concluding that cognitive style differences make themselves felt in cognitive task performance. Certainly, there was no indication that the analytic-global construct, as operationally defined by the CST, would function as a useful control over individual differences in the investigation of cognitive task performance.

Prediction 2

Task orientation will improve the performance of both splitters and lumpers on each task. This prediction was made on the assumption that the long-standing mental sets which a subject might bring to a cognitive task situation would be amenable to modification in the light of the specific demands of the task. Where the long-standing set was inappropriate to the task, modification would be in the direction of greater appropriateness. Where the long-standing set was already appropriate, modification would take the form of reinforcing a subject s readiness to act in accordance with his long-standing personal predispositions. In either case, it was anticipated that the effect of preliminary task orientation would be to improve a subject's performance on a task.

The results of this study showed that preliminary task orientation was a significant variable for the concept attainment task, but not for the embedded figures task. In the concept attainment task, however, task orientation interacted with the factor of cognitive style, indicating that its effect was dissimilar for the two cognitive style groups. For neither group, moreover, could this factor be interpreted as operating in the manner predicted.

For the splitters, performance on the concept attainment task was poorer under both the low and the high task orientation conditions than it was under the condition of no task orientation. Differences in the mean performance time scores, however, were not statistically significant.

Lumpers showed a similar deterioration of performance under the low task orientation condition. In the high task orientation condition mean performance time was significantly better than performance time in the low orientation condition ($p < .05$), and considerably better than performance time in the no task orientation condition. The difference, however, between mean scores in these two conditions was not statistically significant.

Since the significant interaction between task orientation and style group reflected performance only in the high orientation condition, mean performance times for the total sample in the no orientation condition and the low orientation condition were tested for the significance of the difference. The difference was found to be significant at the .05 level of significance. This allowed the effect of task orientation to be interpreted as one that produced poorer performance in subjects. This interpretation applied, of course, only to the low condition of task orientation. In the high condition of task orientation, the situation reversed itself for the lumpers but not for the splitters. It could not be said, however, that lumpers actually benefited from task orientation since even in the high condition of orientation their mean performance score was not significantly better than it was in the no orientation condition.

Task orientation, then, not only failed to produce an increase in performance efficiency but actually resulted in poorer performance. If task orientation had simply failed to produce any effect, the results could have been interpreted simply enough as indicative of the relatively minor role played by initial task set in determining ultimate outcome in a task as complicated and involved as the five-attribute concept attainment task used in the present study. Interpretation of the negative effect actually produced was a more difficult proposition. It was the investigator's opinion that the negative result bore some relation to the manner in which task orientation was given.

In demonstrating the conservative focusing strategy for attaining concepts the investigator had to enlist the cooperation of subjects, requiring them to compare each selection made by the investigator with the exemplar so as to tell the investigator whether or not his selection was an instance of the concept. This active participation on the part of subjects may have distracted their attention from what the investigator was attempting to demonstrate, with the result that they were unable to discover the pattern in what he was doing. When they were later asked to perform the task themselves, their performance may have been impaired because they believed they did not know how to do it, this belief having been engendered by their failure to have discovered the investigator's method.

With respect to the effect of preliminary task orientation on the embedded figures task, the results seem best interpreted as indicating that task orientation had no effect. Only the splitters in the low task orientation condition showed any indication that orientation had improved performance. The overall effect of the factor, however, proved to be insignificant, and it would seem best to look on all mean performance scores as mere chance variations.

In summary, the effect of preliminary task orientation was different for the two tasks. For the concept attainment task, preliminary orientation actually reduced problem solving efficiency The only exception to this trend was the improved performance of the lumpers in the high task orientation condition. The benefit to this group, however, was not sufficient to make their performance significantly better than the performance of subjects in the no task orientation condition. For the embedded figures task, orientation had no effect on task performance.

Prediction 3

Lumpers will benefit from task orientation to a greater extent than splitters. This prediction was based on the assumption that splitters already had a long-standing mental set that was appropriate to the tasks investigated in this study. Task orientation, therefore, was expected to be more beneficial to the lumpers since in their case it would be inducing a set that was more appropriate to the task rather than merely reinforcing a set they already possessed.

Verification of this prediction would have required a significant interaction effect between cognitive style and task orientation, such that lumpers would have been significantly poorer than splitters in the no task orientation condition and comparable in performance in the high task orientation condition, with the relationship between the style groups in the low task orientation condition being somewhere between these two extremes. This did not happen for the embedded figures task. For the concept attainment task something approaching it happened since splitters performed better under the condition of no task orientation and lumpers were better under the condition of high task orientation. The latter difference was significant at the .05 level of significance, and the former difference was not significant. The irregularity of the effect of the task orientation factor, however, suggested that there was insufficient evidence for claiming that this predicition had been verified in the case of the concept attainment task.

Prediction 4

The differences which have been predicted to obtain between splitters and lumpers will be more evident when problem difficulty level is low than when it is high. In this study cognitive style was conceptualized as a long-standing mental set which a subject brings to a cognitive task situation. In the actual task situation, however, it was believed that the immediate task set under which a subject would operate would be one that also reflected the direction coming from the nature of the task itself. It was assumed that when problem difficulty level was low, the demands of the task would exert minimal effect on a subject's performance. His performance then would be maximally under the control of his long-standing mental sets. When task difficulty level was high, the converse situation was assumed to exist. This led to the expectation that the effects of cognitive style and preliminary task orientation would be more evident with problems of low difficulty level than with problems of high difficulty level.

Prediction 4, obviously, was also contingent upon the successful verification of the first three predictions. Since these predictions were not verified to any significant extent, it seemed superfluous to discuss the findings relevant to Prediction 4 beyond pointing out the following: the lack of any significant interactions of problem difficulty level with either or both of the between subjects factors indicated that what was found to be true of these factors was true at all levels of problem difficulty. Thus, the findings already discussed may be considered to have generality over at least two levels of problem difficulty, since in both the concept attainment task and the embedded figures task, problems were found to have been at two significantly different levels of difficulty.

The Relationship Between Scores on the Concept Attainment Task and the Embedded Figures Task

One of the problems connected with the study of the analytic-global dimension of cognitive style has been the use of single-criterion measures to define what well may be a multidimensional construct. The two cognitive tasks examined in this study were chosen because they had potential utility in the explication of this problem. Their power in this respect stemmed from the fact that if the various single-criterion measures presently being used to define the analytic-global style are actually measuring the same theoretical construct, then performance on these measures should be interrelated.

The findings already presented in this chapter have shown that there was no relationship between analytic scores on the CST and performance on the two supposedly analytic tasks investigated. This lack of relationship was particularly noteworthy for the embedded figures task, since Witkin has used a task of this type to operationally define the analytic-global dimension of style. Because the concept attainment task was only assumed to be analytic in nature, the lack of relationship between performance scores on this task and analytic scores on the CST was not in itself considered sufficient evidence to infirm the notion that socres on the CST may be used to define a theoretical construct of wide cognitive generality.

Because this was so, however, two additional measures were taken of the manner in which subjects performed this task, the conservative focusing strategy score and the score representing the number of instances examined before a subject gave his first response to a concept problem. The conservative focusing strategy is clearly an analytical method for attaining a concept. The lack of relationship, therefore, between obtaining an analytical score on the CST and following a conservative focusing strategy was considered stronger evidence against the cognitive generality of whatever construct is being measured by the CST. Counting the number of instances examined before a conclusion was drawn about the attributes comprising a concept seemed an adequate measure of a subject's lack of cognitive impulsiveness,a trait which Kagan and his colleagues (1964) believe to be one of the two major hallmarks of analytic cognitive functioning. Thus, the fact that analytic subjects in this study did not differ from global subjects on this measure of concept attainment also argued against the cognitive generality of the construct being measured by the CST.

Further evidence for the lack of cognitive generality in these single criterion measures was found in the lack of relationship in performance on the two cognitive tasks themselves. Table 13 shows the Pearson product-moment correlation coefficients obtaining between the scores on these two tasks. In computing these coefficients, scores on the concept attainment task were averaged over the four problems, since it had been found that the performance of subjects did not significantly interact with the difficulty level of the problems. Scores from parts II and IV of the embedded figures task were disregarded because inconsistent results had occurred when subjects were not allowed to refer visually to the problem figure while performing these parts of the task. Parts I and III were examined separately because Thurstone (1944) found that these two tasks had distinctly different factor loadings when they were studied in connection with performance on a variety of perceptual tasks.

TABLE 13

PEARSON PRODUCT MOMENT CORRELATION COEFFICIENTS
OBTAINING BETWEEN SCORES ON THE CONCEPT ATTAINMENT TASK
AND THE EMBEDDED FIGURES TASK

EMBEDDED FIGURES TASK SCORES	CONCEPT ATTAINMENT TASK SCORES		
	Time on Task	Conservative Focusing Strategy Score	Instances to S's First Response
Part I	-.009	-.028	.157
Part III	-.260*	-.047	.056

* $\underline{p} < .05$

As Table 13 shows, the relationship between performance on Part III of the embedded figures task and the time taken to attain concepts was significant. This finding was consistent with Thurstone's finding that performance on complex embedded figures loads on the same factor as performance on complex verbal reasoning tests of the primary mental abilities (Thurstone, 1944, p. 11) The embedded figures used by Witkin to define the analytic-global construct are figures of this complex type, thereby giving rise to the expectation that his operational measure for the analytic-global construct would follow the pattern of relationships found here for the Part III figures.

The finding of importance in the data of Table 13 was the lack of relationship between performance on the embedded figures task and scores on the two style scores of the concept attainment task. This finding indicates that the significant correlation between scores on Part III of the embedded figures test and time scores on the concept attainment task should be interpreted as a relationship of ability independent of style considerations. This finding indicates that being analytical in a context where the emphasis was on conceptual matters was not the same as being analytical in a context where perception is emphasized. It also argued in favor of accepting the multi-dimensional nature of the analytic-global construct as one that resists adequate definition by single-criterion measures.

The lack of a relationship between concept attainment scores and scores on the embedded figures task, moreover, served to justify generalizing the findings concerning the effect of cognitive style on cognitive functioning. These previously reported findings, in other words, were ones that applied to cognitive tasks which tapped significantly different aspects of cognition, specifically differences associated with the relative importance of perceptual and conceptual factors. This generality of the findings across different cognitive tasks was, of course, limited by the relationship found between concept attainment scores and the scores on Part III of the embedded figures task. The correlation coefficient here, however, while significant appeared low enough to justify maintaining that these two tasks were more dissimilar than they were similar.

In summary, the lack of relationships among the three single-criterion cognitive style measures examined in this study argued against the supposition that they were measuring the same theoretical construct, or the same aspects of the construct, if in fact this construct was multidimensional. The lack of relationship between concept attainment performance and performance on the embedded figures task was evidence that findings on the effect of cognitive style on cognitive functioning had generality across widely differing cognitive tasks.

Summary

The results of this study supported the assumption that the analytic-global dimension of cognitive style defined by the CST was a matter of an individual's personal preference and not his capability for making analytic or global conceptual categorizations.

The hypothesis that individuals who differed on this dimension of cognitive style would perform cognitive task differentially was not supported by the findings of the study. Performance time measures were taken on two cognitive tasks, the attainment of conjunctive concepts and the perception of embedded figures. In neither case did analytic subjects and global subjects perform differently. This finding generalized across problems existing at two levels of problem difficulty.

For the concept attainment task, in addition to the time taken by subjects to attain a concept, measures were also taken of the strategy used seeking concepts and the amount of information required before a first response was given to a concept problem. These latter two measures, conceived and justified more as style than ability measures, also failed to reveal any performance differences in cognitive functioning between analytic and global subjects.

In this investigation an attempt was also made to vary the effect of cognitive style on cognitive functioning by giving both analytic and global subjects varying levels of preliminary task orientation. Task orientation resulted in poorer performance on the concept attainment task and had no effect on the perception of embedded figures.

Lastly, it was found that no performance relationships existed among the three cognitive measures investigated. This indicated that single criterion measures are inadequate for defining broad theoretical constructs of cognitive style such as the analytic-global style dimension. The lack of relationship between concept attainment and perception of embedded figures indicated that these factors tapped different aspects of cognitive functioning. This justified attributing generality to the findings concerning the effect of cognitive style on cognitive functioning.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

This study was designed to investigate the effect of cognitive style on cognitive task performance. The specific cognitive style variable examined was the analytic-global construct operationally defined by the preference for making analytic-conceptual groupings on the Conceptual Style Test (CST). The attainment of conjunctive concepts and the perception of embedded figures were the cognitive tasks on which performance was studied. Performance on both tasks was investigated under conditions which exercised control over problem difficulty level and preliminary task orientation.

Since both tasks were considered analytical in nature, it was hypothesized that they would be performed more successfully by subjects whose style was analytic (splitters) than by subjects whose style was global (lumpers). Four specific results were predicted:

1. Splitters will outperform lumpers on both tasks.
2. Task orientation will improve the performance of both splitters and lumpers on each task.

3. Lumpers will benefit from task orientation to a greater extent than splitters.

4. The differences which have been predicted to obtain between splitters and lumpers will be more evident when problem difficulty level is low than when it is high.

The Sample

The sample was drawn from a population of 120 8th grade junior high school students. The CST was administered to these students, and the 24 students with the highest analytic scores and the 24 students with the lowest analytic (global) scores were selected as subjects. The terminology of Kagan and his colleagues (1963) was followed in designating analytic subjects as splitters and global subjects as lumpers. School record data revealed no significant differences between splitters and lumpers in scholastic aptitude, school achievement, and parental occupation. Each group had 13 boys and 11 girls.

The selection of subjects was based on the first of two administrations of the CST. A second administration of the CST, in which students were instructed to find other ways of making conceptual groupings, was held in order to support the assumption that this test was a measure of preference and not capability for making either analytic or global categorizations.

Design of the Study

For each task studied, the factors of cognitive style and preliminary task orientation were varied between subjects, while the factor of problem difficulty level was varied within each subject. This was accomplished by randomly assigning subjects in each style group to one of three conditions of preliminary task orientation. For each task, preliminary orientation consisted of having the investigator demonstrate how the tasks could be performed. Subjects in the high task orientation condition received two demonstrations and subjects in the no task orientation condition received none.

For both tasks, every subject was tested on four problems. The order of tasks and of problems within tasks were randomized for presentation to each subject.

The concept attainment task required subjects to find the criterial attributes which conjunctively defined a class or category of objects existing with the universe of all such objects. In this study an object possessed 5 attributes, each having two possible values, thereby making a universe of 32 such objects. Subjects were shown an object which belonged to one of the possible sub-sets of objects within the universe and then asked to discover the attribute value(s) which defined that sub-set by inquiring about the membership of other objects. In response to each inquiry subjects were told whether or not the object was a member.

Ability on this task was measured by the time it took subjects to discover the concept, or conjunction of attribute value(s), defining the sub-set. Additionally, their inquiry protocols were examined to measure the extent to which they adhered to a conservative focusing strategy of inquiry; that is, one in which only one attribute value was varied at a time, all other attribute values being held constant. A count was also made of the number of inquiries a subject made before he stated his first conjecture about the concept he was seeking. While the time score was a measure of a subject's ability to attain concepts, the latter two measures were an attempt to study differences in the manner, or style, in which he attained concepts. The difficulty level of problems was controlled by varying the number of attributes criterial to a concept from one to four. A random selection procedure was used to select the specific criterial attribute values for each problem.

The embedded figures task required a subject to find a simple figure embedded in a complex one. The embedded figures employed were the Thurstone-Gottschaldt figures (1944). Parts I through IV of this test were used as the four problems in the study. Parts I and II contained less difficult figures than Parts III and IV. Difficulty within these two sub-sets of figures were further varied by having subjects work on Parts II and IV without being able to look at the example of the simple figure being sought. The measure of ability of this task was the number of figures disembedded per minute. For each part of the task, time limits were set in accordance with the recommendations of Thurstone (1944). Part V of this same test was used for the preliminary task orientation given subjects.

Results

The assumption that the CST measures a subject's preference and not his capacity for making analytic or global categorizations was supported by the finding that the 120 students who took this test were able to give, on the average, both analytic and global responses to more than half the items. This finding was also true for the sample of students selected as subjects for the study.

The data failed to support the hypothesis that cognitive style is a significant determinant of cognitive task performance. Contrary to expectation, preliminary task orientation did not improve task performance and in the case of concept attainment actually produced poorer performance. Variation in problem difficulty level yielded problems at two significantly different levels of difficulty. For both tasks, the effect of cognitive style and task orientation was similar at both difficulty levels.

The four predictions made were disconfirmed. Specifically, it was found:

1. On neither task did splitters outperform lumpers. For both tasks the overall performance of the two style groups was equivalent. On the concept attainment task, a significant interaction between style and orientation directed attention to the fact that in the high condition of task orientation lumpers significantly outperformed splitters. There were no other significant differences in the performance of the two style groups.

2. Preliminary task orientation had no effect on the ability to perceive embedded figures among either splitters or lumpers. With respect to the concept attainment task, results were more complicated. For both groups, the low task orientation condition of two demonstrations resulted in poorer performance. Under the high task orientation condition of four demonstrations, the performance of splitters remained equally poor, but lumpers showed an improvement that was significantly better than their performance under the low condition of task orientation, but not significantly better than their performance in the no task orientation condition.

3. Generally speaking, neither splitters nor lumpers benefited from preliminary task orientation, and Prediction 3 thereby became meaningless. For the concept attainment task, however, the lumpers in the high orientation condition did benefit from task orientation and their performance was superior to the performance of splitters in that condition. To this limited extent, there was some indication of lumpers evidencing more benefit from task orientation than splitters.

4. While the differences predicted at the outset of the study did not materialize, the performance which actually did obtain for both style groups under each condition of task orientation was the same under both high and low levels of problem difficulty level. In this sense, it can be said that Prediction 4 was disconfirmed.

Conclusions and Implications

Conclusions were drawn from the results of this study in terms of the implications the data had for furthering the explication of the analytic-global dimension of cognitive style and for assessing the validity of Kagan's recommendation that this dimension be used to order and control individual differences in experimental studies of cognitive behavior. In this respect, two major conclusions were reached:

1. Single-criterion measures of the analytic-global dimension of cognitive style, such as the CST, give evidence of being too task specific to permit them to identify individual differences in cognitive functioning that have the generality required by the theoretical construct of "style" as pervasive and self-consistent cognitive behavior.

This conclusion was based on the lack of relationship found among performance on the CST, the concept attainment task, and the embedded figures task. Since all of these measures have been justified, in some fashion, as operational definitions of the analytic-global construct of cognitive style, performance on them should have been correlated if they were defining the same theoretical construct. At best, the data from this study could only justify the conclusion that these operational measures were defining separate aspects of a multidimensional construct.

2. The data of this study failed to justify Kagan's recommendation that individual differences in experimental studies of cognitive functioning be ordered and controlled by means of the analytic-global dimension of cognitive style defined by the CST.

This conclusion was based on the lack of performance differences obtaining between analytic and non-analytic subjects on both the concept attainment task and the embedded figures perception task. On a prima facie basis, these two tasks appeared to give differential emphasis to perceptual and conceptual factors. Empirically, performance on the one was not related to performance on the other. This was evidence that they represented different cognitive functions and probably sampled a diverse population of cognitive behavior. The failure of differences on the CST to have any meaning in terms of performance on these two tasks therefore leads to the conclusion that the evidence in this study does not support the contention that the analytic-global dimension of cognitive style defined by the CST is a personality variable of general cognitive relevance. Without that generality, of course, this dimension could serve no useful purpose in ordering or controlling individual differences in experimental studies of cognitive functioning.

This conclusion was strengthened by the fact that the two tasks used to test the cognitive generality of the analytic-global dimension examined should have been particularly sensitive to individual differences in that dimension. The perception of embedded figures has been used by Witkin to give operational definition to a similar, if not the same theoretical construct. The concept attainment task lent itself to an examination not only of a subject's ability to perform an analytic task but of his tendency to employ an analytic approach (conservative focusing strategy) to the solution of the task. Additionally, since Kagan and his colleagues have found analytic subjects to be more reflective and global subjects more impulsive in making responses, the concept attainment task was used to measure the degree to which subjects delayed coming to a first decision about the criterial attributes of the concepts they were seeking. This measure of impulsiveness, of course, was specific to the concept attainment task used in this study. It was not therefore directly comparable to the measures used by Kagan and his colleagues for assessing differences in subject impulsivity. Thus the contradictory findings in this study do not directly disconfirm the earlier findings of the Kagan group.

One possible explanation of the singular lack of task performance differences between the two style groups was the manner in which the CST is scored. It seems possible that scoring the test simply on the basis of first responses to items might be an inadequate method for detecting deeply personalized differences. First responses might reflect too much that was of a chance, momentary nature in a subject's performance. The likelihood of this possibility was enhanced by the finding that responses on more than half the items on the CST are typically a matter of subject preference and not ability. This was a finding of some generality since it was true not only for the subjects of the study but for the population of students from which the sample was drawn. It is recommended therefore that the possibility be investigated of scoring the CST on the basis of exhausting each subject's repertoire of responses to each item and identifying his predominant cognitive style on the basis of all his responses and not just his first responses.

The two major conclusions drawn from the data of this study were based on the findings relevant to the factor of cognitive style. The findings related to the two other factors, preliminary task orientation and problem difficulty level, also had noteworthy implications.

Preliminary task orientation emerged in this study as a poorly chosen variable. It produced results that were contradictory to the notion that appropriate orientation would benefit task performance, indicating that it was a variable which itself needs further investigation. Lacking predictability in its own right, its use in a study primarily concerned with the effects of another factor only served to confound the findings and increase the difficulty of giving them a satisfactory interpretation.

Even if the effect of preliminary task orientation had been empirically consistent with its logically expected outcome, it would have been a poor choice as a variable intended to give insight into the nature of the cognitive style variable. This was so because it was a variable which affected the long-standing mental set conceptualized as the actual psychological process producing cognitive style effects. To attempt directly to modify this process before its basic functioning was clearly established seemed, in retrospect, to have been a mistake.

It should also be pointed out that preliminary task orientation in this study did not consist of the typical training trials given subjects in learning experiments. Orientation in this study merely involved demonstration. It is not known what the effect would have been if orientation had consisted of preliminary practice or training trials. Perhaps this type of preliminary orientation would have shown a resultant increase in task performance and have detected differences in the rate of learning for the two style groups. This is certainly a potential difference between style groups deserving further investigation, and in this type of study the objections made here against the use of a task orientation factor would not obtain.

Examining cognitive style variables under differing levels of problem difficulty, on the other hand, seems worthwhile. This variable did not directly attempt to modify the psychological process under investigation. The generality which consideration of this type of variable can add to the results of a study takes place without the risk of confounding the results pertinent to an understanding of the process being studied.

In this study it was found that differences in problem difficulty level did not significantly change the relative performance of the two style groups on either task. The range of difficulty level for the problems in these tasks, however, was not considered to be very wide. All four problems in both tasks were ones that were well within the capacity of subjects to perform. In fact, they had been selected with this in mind. The variation in cognitive strain under which subjects performed task problems, therefore, was not excessive, and the effect of style obtained in this study should be interpreted as applying only to problems well within the ability level of subjects.

What the effect on style would be for problems outside this range is a problem recommended for further investigation. It is possible that style differences only become important under extreme differences in the degree of cognitive strain elicited by task problems. If this were the case, then it would also become necessary to study variations in subject performance not in terms of success on task but of errors made and of changes in problem solving approach. Methods for doing this have already been suggested by Sigel (1963). Not all tasks, of course, would lend themselves to this type of analysis. In the case of the tasks studied here, the concept attainment task would be suited to such analysis, but not the embedded figures task.

In summary, it can be concluded from the results of this study that further investigation of both the manner of measuring the analytic-global dimension of cognitive style and the examination of its effect on cognitive functioning are necessary before such measures of individual differences in cognitive behavior can serve a substantively clear and methodologically useful purpose in the experimental investigation of cognition.

APPENDICES

APPENDIX A

EXPERIMENTAL TREATMENT PROTOCOL FOR EACH SUBJECT

Subject	CONCEPT ATTAINMENT TASK				EMBEDDED FIGURES TASK				Task Order
	First Concept	Second Concept	Third Concept	Fourth Concept	Part I	Part II	Part III	Part IV	
SPLITTERS									
S01-I	GTSLp	CLp	3	GRRp	3	1	4	2	CP
S02-I	C3	TC3Rp	Lp	RC2	4	3	2	1	CP
S03-I	GC3Rp	G	S2Lp	TRp	3	4	2	1	PC
S04-I	R	CLp	GS3	GR3Lp	1	4	2	3	CP
S05-I	BRS	GRCRp	T	CRp	3	4	1	2	PC
S06-I	GTS2	Rp	S2	G2Lp	3	1	2	4	PC
S07-I	G3Rp	TLp	Lp	TC2Lp	1	3	2	4	PC
S08-I	BR	2	GR2	GBC3	1	4	3	2	CP
S09-II	G3Lp	TC3Rp	Lp	S3	3	2	1	4	PC
S10-II	T	BC2	CLp	GS2Rp	3	1	2	4	CP
S11-II	BRp	RC2Rp	2	T2Rp	1	4	3	2	PC
S12-II	GTC2	S	CLp	BS3	3	2	1	4	CP
S13-II	T2Lp	BS	2	BC3Rp	2	4	1	3	CP
S14-II	CLp	TC3	S	BT3Lp	1	4	3	2	PC
S15-II	R	G2	GTS	TC3Rp	1	2	3	4	CP
S16-II	CLp	RSRp	BC3Lp	G	3	2	1	4	PC
S17-III	B	TC3Lp	BS	GRRp	2	4	3	1	CP
S18-III	TSRp	BT2Rp	RS	S	3	4	1	2	CP
S19-III	S	RC2Lp	TRp	TSLp	4	1	3	2	PC
S20-III	T2Rp	GS2Rp	CS	Rp	2	1	4	3	CP
S21-III	G2Lp	SLp	Rp	GRC2	4	2	3	1	CP
S22-III	GRp	Lp	BC2Rp	BRS	1	4	3	2	PC
S23-III	2Rp	TSLp	GTS3	C	1	4	3	2	PC
S24-III	C	BTRp	B2	TC3Rp	2	1	3	4	CP

LUMPERS

L25-I	GRLp	T	3Lp	GR3Lp	1	3	2	4	CP
L26-I	G	R2	GRC	RTC3	1	3	2	4	PC
L27-I	R	R3Lp	GR2Lp	RRp	2	4	3	1	CP
L28-I	RLp	GRLp	3	GS3Rp	4	1	3	2	PC
L29-I	RS2Rp	T	TC2	R3	4	2	1	3	CP
L30-I	RS3	3Rp	BC3Rp	Rp	3	4	2	1	PC
L31-I	GT	RR3Rp	TS3	T	3	2	4	1	CP
L32-I	RS3Rp	GC	CTRp	Rp	1	2	3	4	PC
L33-II	RS2	GTS2	C2	C	2	4	3	1	CP
L34-II	Lp	TC3Rp	RC	GSRp	4	2	1	3	PC
L35-II	TCLp	R	R2	TS2Lp	3	4	1	2	PC
L36-II	SLp	R	R2Rp	TS2Lp	2	3	4	1	PC
L37-II	BC3Rp	GLp	R2Lp	2	2	3	4	1	CP
L38-II	R3	R	RTLp	RTS2	3	2	4	1	PC
L39-II	RR2Lp	Rp	TS	G2Rp	3	1	2	4	CP
L40-II	S	GCRp	GC3Rp	2Lp	1	3	2	4	CP
L41-III	RR	RTS2	GT2	Lp	1	3	4	2	PC
L42-III	RRp	RTS	RR3Lp	T	3	2	4	1	CP
L43-III	G	BC3Lp	RLp	GTLp	4	2	1	3	CP
L44-III	GRp	TC2	G	CTC3	4	3	[illegible]	1	CP
L45-III	GTLp	GT2Rp	G	RRp	2	4	3	1	CP
L46-III	R2Rp	2	RR2Lp	2Rp	4	1	2	3	PC
L47-III	GC	B	BT2Lp	GC2	4	1	2	3	CP
L48-III	GTRp	RRp	S	GC2Lp	1	4	[illegible]	2	CP

KEY: S - splitter
L - lumper

I Task Orientation condition High
II Task Orientation condition Low
III - No Task Orientation Control Condition)

Attribute Code

Color	G = Green; B = Black
Body	T = Triangle, R = Rectangle
Head	C = Circle. S = Square
Whiskers	2 = Two; 3 = Three
Tail	Rp = points right Lp = points left

C Concept Attainment Task
P Embedded Figures Perception Task

APPENDIX E

SEX, AGE, I.Q., ACHIEVEMENT, AND PARENTAL OCCUPATIONAL GROUP FOR EACH SUBJECT

Subject Number	SEX	AGE	I.Q	8th GRADE FINAL SCHOOL MARKS				CAT SCORES			PARENTAL OCCUPATION GROUP
				English	Soc.Stud	Math	Science	Reading	Arithmetic	Language	
S-01	M	14-2	101	1.00	1.75	2.00	1.25	53	57	50	W
S-02	F	14-4	118	3.00	3.25	2.75	2.00	65	65	58	PB
S-03	M	14-2	105	2.00	2.75	3.00	3.38	73	73	73	M
S-04	M	14-11	102	.75	.00	1.75	.75	47	50	47	W
S-05	F	13-5	116	2.75	3.75	3.25	3.25	58	58	63	PB
S-06	F	13-10	117	3.00	3.25	3.25	3.00	nn	nn	nn	W
S-07	F	13-8	106	2.00	1.75	1.00	2.25	nn	nn	nn	W
S-08	F	14-5	112	2.75	2.75	3.00	2.25	73	73	73	PB
S-09	M	10-7	107	1.00	1.75	1.75	1.25	58	42	46	PB
S-10	M	13-9	100	2.00	1.75	2.00	2.25	50	50	53	W
S-11	F	14-2	123	1.75	1.00	1.00	1.75	65	60	63	PB
S-12	M	13-9	90	.75	.75	.75	1.25	nn	nn	nn	M
S-13	F	13-8	105	1.75	3.00	3.00	1.75	33	47	50	W
S-14	M	13-6	108	.00	2.00	1.75	.75	68	53	53	PB
S-15	F	13-8	130	2.00	1.75	2.75	1.75	66	66	66	PB
S-16	M	14-2	110	.25	.25	3.00	2.00	68	73	68	M
S-17	M	13-6	117	1.00	2.25	1.75	1.00	73	63	68	PB
S-18	M	14-9	101	.75	.75	.75	.00	88	58	60	W
S-19	M	14-2	104	.75	2.75	3.00	1.00	80	50	50	PB
S-20	F	13-6	107	.75	.75	1.75	2.00	83	73	66	PB
S-21	M	14-0	100	.75	2.00	2.00	.75	56	58	60	W
S-22	M	14-3	100	1.00	.75	2.00	2.00	63	63	47	W
S-23	F	14-3	122	.75	.25	.75	1.25	60	27	58	M
S-24	F	13-5	130	2.75	3.00	2.00	2.00	73	63	73	W

L-25	F	14-7	100	1.00	2.00	1.00	1.00	63	63	58	PB
L-26	M	13-10	104	4.00	3.25	3.00	3.00	68	63	66	W
L-27	F	13-5	100	1.00	.75	1.00	.75	47	42	56	W
L-28	M	14-1	112	3.00	3.00	2.25	2.75	na	na	na	PB
L-29	F	13-7	117	3.75	3.75	4.00	4.00	66	66	73	PB
L-30	M	14-1	120	1.25	2.00	1.25	1.75	73	71	71	PB
L-31	F	14-4	107	2.75	2.00	2.00	2.00	na	na	na	PB
L-32	M	14-6	96	.00	1.75	1.75	.75	50	46	45	W
L-33	M	13-5	108	3.00	2.25	3.25	2.75	73	73	73	PB
L-34	M	14-0	100	2.00	3.00	2.75	2.00	50	53	53	PB
L-35	F	14-8	84	2.00	1.25	1.75	1.00	50	53	53	W
L-36	M	14-8	95	1.00	1.00	2.00	1.75	50	55	53	PB
L-37	F	14-3	84	2.00	2.00	2.00	1.75	45	53	55	W
L-38	F	13-7	133	3.75	3.25	3.25	3.75	73	73	71	PB
L-39	M	13-9	114	1.00	2.00	2.00	2.00	45	55	59	W
L-40	F	13-5	120	3.75	3.25	3.25	3.25	na	na	na	W
L-41	M	14-5	95	.00	1.25	.75	1.25	58	55	56	PB
L-42	F	13-7	114	2.00	2.25	3.00	2.00	63	63	53	PB
L-43	F	13-6	117	4.00	4.00	4.00	4.00	73	73	71	PB
L-44	M	14-1	112	3.00	3.00	2.25	2.25	63	73	58	PB
L-45	M	15-0	104	2.25	2.00	3.00	3.25	55	55	50	PB
L-46	F	14-10	86	.75	.00	1.25	1.00	56	55	55	W
L-47	M	14-4	109	2.75	3.00	3.75	3.75	56	66	63	W
L-48	M	14-1	106	1.75	3.00	2.75	2.25	56	56	55	PB

Code: S = splitter
L = jumper

PB = Professional or Business
W = Skilled or Unskilled Worker

CAT = California Achievement Test

na information not available in school record

APPENDIX C

INSTRUCTIONS EMPLOYED IN ADMINISTERING THE CONCEPTUAL STYLE TEST AND A SAMPLE ITEM FROM THAT TEST

First Administration

When you are told to turn the page, you will see three pictures. You are to pick out two of the pictures that are alike or go together in some way. On your answer sheet circle the letters of the two pictures you select and in the space provided write the reason you chose these two pictures.

There are no "right" or "wrong" answers. Usually the reason can be stated in a few words. You do not have to write a complete sentence. You may work at your own speed. If you finish before the others, sit quietly and wait for further instructions.

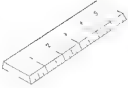
Please begin now by turning the page.

Second Administration

When you were answering the test the first time, you may have felt that there were other ways in which the pictures might be seen as alike. Would you please go through the test again and see if you can find other ways in which two of the three pictures on each page are alike or go together in some way. Write your reason as before on the new answer sheet which has been given to you. Please begin now.

A

B



C

[illegible]

[illegible]

APPENDIX D

SUBJECT RECORD SHEETS

Name of Subject Tommy Jones

Ordinal Position of Task 1

Task Orientation Condition III

CONCEPT ATTAINMENT RECORD SHEET

	Trial Concept	First Concept	Second Concept	Third Concept	Fourth Concept
Concept	R	TSRp	BT2Rp	R3	3
Exemplar	BRC3Rp	19 BTS3Rp	11 BTC2Rp	2 BRC3Lp	1 BRC3Rp
Selections	5 GBC3Rp Yes (R)	33 GTS3Rp Yes (Rp) 27 BTS2Rp Yes (T) 24 GTS3Lp No (TS) 31 GTS2Rp Yes (TSRp)	3 BTC3Rp No 15 GTC2Rp No 12 BTC2Lp No (T2) 13 GBC2Rp No 9 BRC2Rp No (B2Rp) 12 BTC2Lp No (TC2) 10 BTS3Rp No 27 BTS2Rp Yes (BT2Rp)	10 BRC2Lp No (BC) 6 GRC3Rp Yes (C3) 8 GBC3Lp Yes (TC3) 1 RBC3Rp Yes (3) 13 GRC2Rp No (C2) 9 BBC2Rp No 18 BRS3Lp Yes R3)	5 GRC3Rp Yes 2 BRC3Lp Yes (R) 11 BTC2Rp No 3)
		3.2 minutes	6.1 minutes	8.2 minutes	2.1 minutes

Name of Subject Tommy Jones

Ordinal Position of Task 2

Task Orientation Condition III

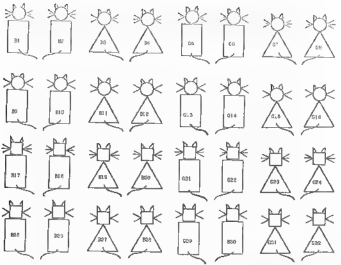
EMBEDDED FIGURES TEST RECORD SHEET

	Test Number	Time Limit	Number of Figures Found Within Time Limit	Number of Figures Found During Extended Time Limit
First Test	3	4.0	4	3
Second Test	4	3.0	5	2 (2.0 min *
Third Test	1	2.0	7	15
Fourth Test	2	1.5	1	2

* Subject found all the figures in less than the allotted time.

APPENDIX E

THE UNIVERSE OF OBJECTS
USED IN THE CONCEPT ATTAINMENT TASK


B1
B2
B3
B4
G5
G6
G7
G8
B9
B10
B11
B12
G13
G14
G15
G16
B17
B18
B19
B20
G21
G22
G23
G24
B25
B26
B27
B28
G29
B30
G31
G32

APPENDIX F

INSTRUCTIONS FOR ADMINISTERING THE CONCEPT ATTAINMENT TASK

I am going to ask you to try to find out what I have in mind about the cats you see on this sheet which makes some of them go together to form a special grouping or class of cats.

For example, from the total group of cats on this sheet I could have in mind: "The class of all green cats," or, "The class of all black cats." Then you see, the class of cats I have in mind would all have one thing in common--their color. Or, I could have had in mind: "All black cats with three whiskers," and then the class of cats I have in mind would have two things in common--their color and number of whiskers. Or, I could have had in mind: "All black cats with three whiskers and a round head," and then the class of cats I have in mind would have three things in common.

So you see it is possible to group things that have only one thing in common, or two things in common, or three things in common, or even more things than that. In the case of the cats on this sheet, there are up to five things they can have in common: shape of head, shape of body, number of whiskers, color, and position--right or left--of tail. Can you point out to me on this sheet a group of cats that have two things in common?

(If the subject is correct in what he points out, he is told: "That's fine! Now, show me a group that has one thing in common." Again, if he is correct, he is told: "That's fine. You have the idea.")

Now I am going to pick out a cat and it will be an example of the class of cats I have in mind. Then you pick other cats, one by one, and I'll tell you if you have picked a cat that belongs to the class of cats I have in mind. As I tell you this about the cats you pick out, you try to figure out what it is I think these cats have in common. We will do this four times after we practice a little.

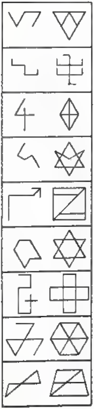
Now, let's see if you have the idea. If I pointed out a black cat, say that one in the upper left hand corner, and then you pointed out the green cat that is in the same position, I would tell you "Yes" or "No", according to whether or not the cat you picked out belonged to the class of cats I have in mind. Now, at any time that you think you know the class of cats I have in mind--that is, know what it is that the cats have in common--you tell me what those common features are. You will be allowed one such guess each time you pick a new cat. So always make the most careful guess you can, you don't want to waste your guesses. When you make the right guess I will tell you. Good guessers, of course, are able to get the right answer with only a small number of guesses.

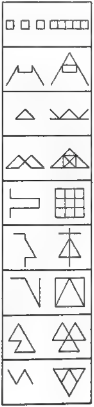
APPENDIX G

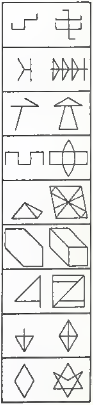
THE THURSTONE-GOTTSCHALDT FIGURES

PART I

In each pair of figures below, mark that part of the second figure which is the same as the first.



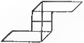


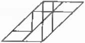


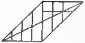
PART II

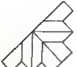
Look at the adjacent figure.

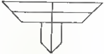
It is contained in each of the drawings below. Find it in each drawing and then mark it. Mark only one figure in each drawing.

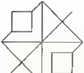




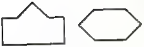






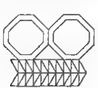


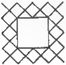
PART III

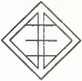


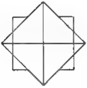
Look at the two adjacent figures. One of them is contained in each of the drawings below.

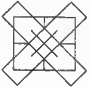
In each of the following drawings, mark that part which is the same as one of the adjacent figures. Mark only one figure in each drawing.

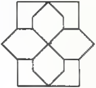


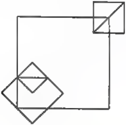






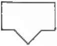


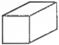




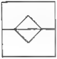
PART IV

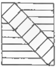
Look at the two adjacent figures. One of them is contained in each of the drawings below.

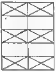


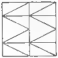


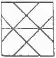
In each of the following drawings, mark that part which is the same as one of the adjacent figures. Mark only one figure in each drawing.

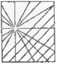


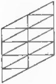


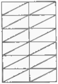


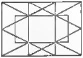


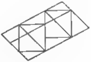






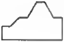


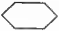




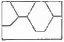
PART V

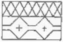
Look at the two adjacent figures. One of them is contained in each of the drawings below.

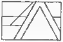


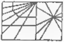


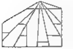
In each of the following drawings, mark that part which is the same as one of the adjacent figures. Mark only one figure in each drawing.

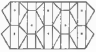


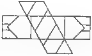


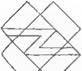


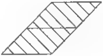


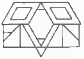












APPENDIX H

TIME IN MINUTES TAKEN BY SUBJECTS TO ATTAIN CONCEPTS

S's No.	CONCEPTS Number of Criterial Attributes 1	2	3	4	S's No.	CONCEPTS Number of Criterial Attributes 1	2	3	4
1	2.95	10.00	3.46	10.00	25	3.20	70	2.20	1.00
2	3.11	8.60	8.06	7.08	26	1.06	1.78	1.26	1.50
3	2.58	5.09	10.00	3.62	27	1.80	10.00	5.00	3.30
4	2.52	10.00	10.00	10.00	28	1.17	4.02	4.68	5.08
5	10.00	1.06	10.00	.78	29	3.05	10.00	3.46	4.90
6	4.81	1.60	4.30	10.00	30	1.10	1.80	2.30	1.60
7	1.99	10.00	10.00	8.60	31	.80	2.20	1.20	10.00
8	6.12	4.83	7.20	1.72	32	6.00	3.50	10.00	10.00
9	10.00	3.60	10.00	2.00	33	2.05	4.90	4.20	1.80
10	2.61	1.81	4.15	10.00	34	5.08	10.00	10.00	9.55
11	3.04	10.00	6.00	7.60	35	2.81	5.45	10.00	10.00
12	10.00	10.00	10.00	10.00	36	10.00	9.70	10.00	4.50
13	4.30	1.00	10.00	4.30	37	3.40	10.00	4.00	10.00
14	2.90	10.00	9.90	10.00	38	10.00	8.86	10.00	10.00
15	2.07	7.80	4.40	4.95	39	3.32	8.28	8.72	2.56
16	1.00	1.00	10.00	10.00	40	2.20	4.70	4.40	5.20
17	1.84	1.68	1.93	8.76	41	1.30	8 10	4.80	2.30
18	2.10	6.20	3.20	5.10	42	.80	9.80	3.00	1.10
19	1.70	6.80	10.00	2.30	43	4.40	1.20	2.20	10.00
20	4.68	.81	10.00	10.00	44	1.60	10.00	8.70	1.40
21	4.50	10.00	1.80	7.80	45	9.40	2.00	2.25	10.00
22	1.60	6.10	2.90	2.90	46	10.00	2.90	10.00	10.00
23	2.50	3.90	10.00	5.60	47	7.10	10.00	6.30	10.00
24	2.60	9.70	1.70	2.00	48	1.96	1.50	1.97	1.83

APPENDIX I

CONSERVATIVE FOCUSING STRATEGY SCORES

	CONCEPTS					CONCEPTS			
S s	Number of Criterial Attributes				S's	Number of Criterial Attributes			
No.	1	2	3	4	No.	1	2	3	4
1	1.00	1.17	1.20	1.33	25	1.33	1.00	1.33	1.00
2	1.00	1.66	1.25	1.00	26	1.25	1.50	1.00	1.25
3	1.33	1.50	1.50	1.33	27	1.00	1.00	1.50	1.33
4	1.00	1.00	1.80	1.00	28	1.00	1.33	1.25	1.16
5	1.33	1.50	2.00	1.00	29	1.50	1.20	1.25	1.33
6	1.50	1.33	1.00	1.00	30	1.00	1.20	1.25	1.25
7	2.00	2.00	1.33	2.00	31	1.00	1.00	1.00	1.16
8	1.17	1.40	1.20	1.00	32	1.33	1.00	1.88	2.12
9	1.00	1.50	2.61	1.75	33	1.00	1.44	1.16	1.16
10	2.00	1.00	2.00	1.00	34	1.00	1.50	2.00	1.20
11	1.20	1.00	1.62	1.33	35	1.50	1.33	2.00	1.50
12	1.00	1.16	1.00	1.16	36	1.33	1.25	2.33	1.66
13	1.50	2.30	1.50	1.00	37	1.00	1.00	1.00	1.50
14	1.00	2.66	1.33	1.00	38	1.00	1.70	1.75	1.33
15	1.00	1.83	1.16	1.20	39	1.25	1.00	1.00	1.40
16	1.66	1.33	1.60	1.66	40	2.00	1.20	1.00	1.40
17	1.50	1.20	1.00	1.66	41	1.00	1.25	1.00	1.20
18	1.00	1.00	1.00	1.00	42	1.00	1.50	1.20	1.00
19	1.25	1.00	2.00	1.83	43	2.00	1.50	1.00	1.50
20	1.00	1.00	1.00	1.00	44	2.00	1.33	2.00	1.00
21	1.00	1.00	1.50	1.25	45	1.25	1.00	1.20	1.66
22	1.50	1.00	1.25	1.20	46	1.20	1.25	1.50	2.00
23	1.20	1.00	1.50	1.33	47	1.00	1.75	1.00	1.25
24	1.00	1.00	1.33	1.00	48	1.20	1.00	1.66	1 00

APPENDIX J

NUMBER OF INSTANCES EXAMINED
BY SUBJECTS BEFORE GIVING FIRST ANSWER

	CONCEPTS					CONCEPTS			
S's	Number of Criterial Attributes				S s	Number of Criterial Attributes			
No.	1	2	3	4	No.	1	2	3	4
1	5	6	5	3	25	3	3	4	4
2	1	3	4	3	26	4	4	5	4
3	3	4	2	8	27	5	2	2	3
4	6	3	12	5	28	6	3	7	6
5	3	3	4	2	29	3	5	4	8
6	2	3	1	1	30	5	5	4	4
7	2	1	4	5	31	4	5	4	6
8	7	6	5	5	32	3	4	19	8
9	1	2	13	8	33	6	13	6	6
10	4	6	4	5	34	5	4	8	12
11	5	2	10	9	35	4	3	5	2
12	8	10	6	6	36	3	9	3	10
13	2	3	4	3	37	2	6	4	7
14	3	8	3	2	38	6	17	4	7
15	7	7	10	6	39	4	2	1	5
16	3	3	5	15	40	5	5	5	1
17	3	3	5	16	41	4	4	8	5
18	2	1	3	1	42	5	2	5	4
19	4	1	1	4	43	4	2	9	2
20	3	3	1	5	44	4	3	3	3
21	3	4	4	4	45	6	7	7	6
22	7	2	4	5	46	5	4	7	8
23	5	4	2	8	47	4	4	5	8
24	4	4	6	6	48	5	4	7	5

APPENDIX K

RATE (FIGURES PER MINUTE) AT WHICH SUBJECTS DISEMBEDDED FIGURES

EMBEDDED FIGURES TEST									
S's No.	Part I	Part II	Part III	Part IV	S's No.	Part I	Part II	Part III	Part IV
1	9.00	1.00	.50	1.00	25	1.50	6.00	.50	1.66
2	6.50	8.70	1.00	.33	26	5.50	5.00	1.00	.33
3	4.50	2.00	1.00	2.00	27	3.00	.00	.50	.33
4	5.00	5.00	.50	.33	28	4.00	4.00	1.25	2.37
5	7.00	6.00	1.25	2.44	29	4.00	3.00	1.25	2.52
6	4.50	5.00	1.20	3.50	30	5.00	6.00	.50	1.00
7	2.00	1.00	.50	1.00	31	8.00	5.00	2.20	4.80
8	6.50	1.00	2.75	1.62	32	8.50	6.00	.75	2.50
9	7.50	6.00	.75	5.40	33	5.50	2.00	.50	1.33
10	3.00	1.00	1.25	4.84	34	6.00	.00	.25	1.66
11	12.00	8.50	2.25	1.67	35	2.50	3.00	.75	.33
12	5.50	4.00	.00	.66	36	4.50	4.00	.25	1.00
13	5.50	6.00	.75	1.30	37	1.00	1.00	.25	.33
14	10.00	10.00	1.25	1.33	38	4.00	6.00	1.75	2.50
15	8.00	6.00	.50	4.73	39	4.00	7.70	.50	1.00
16	10.50	7.00	1.50	1.66	40	10.50	10.90	2.00	6.65
17	5.50	7.35	2.00	4.50	41	3.00	6.00	.50	2.00
18	3.50	1.00	1.00	1.66	42	6.00	10.30	.75	2.00
19	5.50	4.00	.50	.33	43	10.00	8.10	.75	1.66
20	8.00	7.90	.75	1.00	44	6.50	4.00	1.25	1.00
21	6.00	7.00	1.25	1.33	45	3.50	5.00	.75	.66
22	6.00	8.40	1.25	2.00	46	4.50	6.00	.25	.00
23	5.00	7.80	1.50	2.00	47	10.00	2.00	.75	1.33
24	4.00	.00	1.00	1.66	48	6.50	2.00	1.00	3.08

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BIOGRAPHICAL SKETCH

James P. Doyle was born in New York City, New York. He was graduated from All Hallows Preparatory School in 1944 and received the Bachelor of Arts degree from St. Joseph's College, Yonkers, New York in 1948. While serving in the United States Navy, Mr. Doyle attended Long Beach State College and Immaculate Heart College in California, receiving the Master of Arts in Education degree from the latter institution in 1962.

Upon completion of his service in the United States Navy Mr. Doyle came to the University of Florida as a graduate student in the Foundations of Education Department. He is presently employed as an interim instructor in that department.

Mr. Doyle is a member of Phi Delta Kappa, the American Educational Research Association, the Florida Educational Research Association and the Southeastern Educational Philosophy Association. He has been secretary of the Upsilon chapter of Kappa Delta Pi and is currently serving as chapter president of that society.

This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Education and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Education.

December, 1965

Kimball Wiles
Dean, College of Education

Dean, Graduate School

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